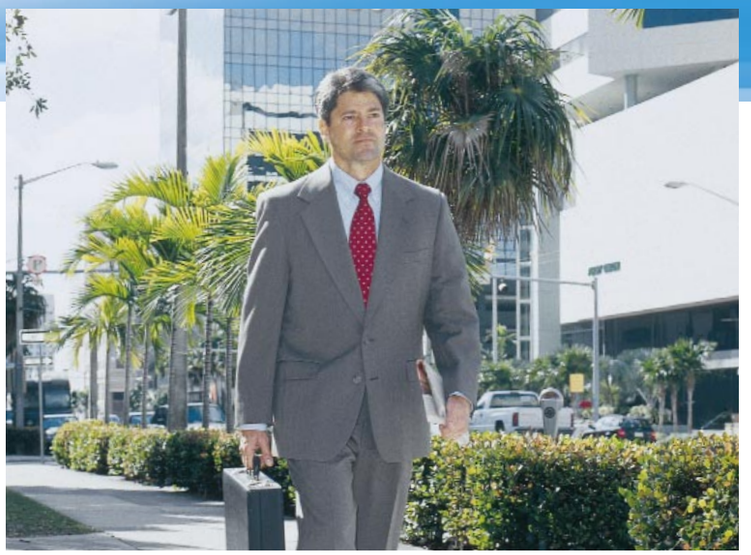
MOTOROLA



Elite Series

Portable Radios

Detailed Service Manual

User Safety, Training, and General Information

READ THIS IMPORTANT INFORMATION ON SAFE AND EFFICIENT OPERATION BEFORE USING YOUR MOTOROLA HANDHELD PORTABLE TWO-WAY RADIO

The information provided in this document supersedes the general safety information contained in user guides published prior to June 2001. For information regarding radio use in a hazardous atmosphere please refer to the Factory Mutual (FM) Approval Manual Supplement or Instruction Card, which is included with radio models that offer this capability.

Compliance with RF Energy Exposure Standards

Your Motorola two-way radio is designed and tested to comply with a number of national and international standards and guidelines (listed below) regarding human exposure to radio frequency electromagnetic energy. This radio complies with the IEEE (FCC) and ICNIRP exposure limits for occupational/controlled RF exposure environment at duty cycles of up to 50% talk-50% listen and should be used for occupational use only. In terms of measuring RF energy for compliance with the FCC exposure guidelines, your radio radiates measurable RF energy only while it is transmitting (during talking), not when it is receiving (listening) or in standby mode. Note that the approved, supplied batteries for this radio are rated for a 5-5-90 duty cycle (5% talk-5% listen - 90% standby), even though this radio complies with the FCC occupational exposure limits at duty cycles of up to 50% talk.

Your Motorola two-way radio complies with the following RF energy exposure standards and guidelines:

- United States Federal Communications Commission, Code of Federal Regulations; 47CFR part 2 sub-part J
- American National Standards Institute (ANSI) / Institute of Electrical and Electronic Engineers (IEEE) C95. 1-1992
- Institute of Electrical and Electronic Engineers (IEEE) C95.1-1999 Edition
- International Commission on Non-Ionizing Radiation Protection (ICNIRP) 1998
- Ministry of Health (Canada) Safety Code 6. Limits of Human Exposure to Radiofrequency Electromagnetic Fields in the Frequency Range from 3 kHz to 300 GHz, 1999
- Australian Communications Authority Radiocommunications (Electromagnetic Radiation - Human Exposure) Standard 1999 (applicable to wireless phones only)
- ANATEL, Brasil Regulatory Authority, Resolution 256 (April 11, 2001) "additional requirements for SMR, cellular and PCS product certification."

Operational Instructions and Training Guidelines

To ensure optimal performance and compliance with the occupational/controlled environment RF energy exposure limits in the above standards and guidelines, users should transmit no more than 50% of the time and always adhere to the following procedures:

Transmit and Receive

- **To transmit (talk)**, **push the Push-To-Talk (PTT) button**; **to receive, release the PTT button.**

Hand-held radio operation

- **Hold the radio in a vertical position with the microphone one to two inches (2.5 to 5 cm) away from the lips.**

Body-worn operation

- **Always place the radio in a Motorola approved clip, holder, holster, case, or body harness for this product.** Use of non-Motorola-approved accessories may exceed FCC RF exposure guidelines.
- If you do not use a Motorola approved body-worn accessory and are not using the radio in the intended use position in front of the face, then ensure the antenna and the radio are kept 2.5 cm (one inch) from the body when transmitting.

Antennas & Batteries

- **Use only Motorola approved supplied antenna or Motorola approved replacement antenna.** Unauthorized antennas, modifications, or attachments could damage the radio and may violate FCC regulations.
- U**se only Motorola approved, supplied batteries or Motorola approved replacement batteries.** Use of non-Motorola-approved antennas or batteries may exceed FCC RF exposure guidelines.

Approved Accessories

- For a list of Motorola approved accessories see the appendix of this user manual or visit the following website which lists approved accessories:

Electromagnetic Interference/Compatibility

Note: Nearly every electronic device is susceptible to electromagnetic interference (EMI) if inadequately shielded, designed, or otherwise configured for electromagnetic compatibility.

Facilities

To avoid electromagnetic interference and/or compatibility conflicts, turn off your radio in any facility where posted notices instruct you to do so. Hospitals or health care facilities may be using equipment that is sensitive to external RF energy.

Aircraft

When instructed to do so, turn off your radio when on board an aircraft. Any use of a radio must be in accordance with applicable regulations per airline crew instructions.

Medical Devices

Pacemakers

The Advanced Medical Technology Association (AdvaMed) recommends that a minimum separation of 6 inches (15 centimeters) be maintained between a handheld wireless radio and a pacemaker. These recommendations are consistent with those of the U.S. Food and Drug Administration.

Persons with pacemakers should:

- ALWAYS keep the radio more than 6 inches (15 centimeters) from their pacemaker when the radio is turned ON.
- not carry the radio in the breast pocket.
- use the ear opposite the pacemaker to minimize the potential for interference.
- turn the radio OFF immediately if you have any reason to suspect that interference is taking place.

Hearing Aids

Some digital wireless radios may interfere with some hearing aids. In the event of such interference, you may want to consult your hearing aid manufacturer to discuss alternatives.

Other Medical Devices

If you use any other personal medical device, consult the manufacturer of your device to determine if it is adequately shielded from RF energy. Your physician may be able to assist you in obtaining this information.

Driver Safety

Check the laws and regulations on the use of radios in the area where you drive. Always obey them.

When using your radio while driving, please:

- Give full attention to driving and to the road.
- Use hands-free operation, if available.
- Pull off the road and park before making or answering a call if driving conditions so require.

Operational Warnings

For Vehicles With an Air Bag

Do not place a portable radio in the area over an air bag or in the air bag deployment area. Air bags inflate with great force. If a portable radio is placed in the air bag deployment area and the air bag inflates, the radio may be propelled with great force and cause serious injury to occupants of the vehicle.

Potentially Explosive Atmospheres

Turn off your radio prior to entering any area with a potentially explosive atmosphere, unless it is a radio type especially qualified for use in such areas as "Intrinsically Safe" (for example, Factory Mutual, CSA, UL, or CENELEC). Do not remove, install, or charge batteries in such areas. Sparks in a potentially explosive atmosphere can cause an explosion or fire resulting in bodily injury or even death.

Note: The areas with potentially explosive atmospheres referred to above include fueling areas such as below decks on boats, fuel or chemical transfer or storage facilities, areas where the air contains chemicals or particles, such as grain, dust or metal powders, and any other area where you would normally be advised to turn off your vehicle engine. Areas with potentially explosive atmospheres are often but not always posted.

Blasting Caps and Blasting Areas

To avoid possible interference with blasting operations, turn off your radio when you are near electrical blasting caps, in a blasting area, or in areas posted: "Turn off two-way radio." Obey all signs and instructions.

Operational Cautions

Antennas

Do not use any portable radio that has a damaged antenna. If a damaged antenna comes into contact with your skin, a minor burn can result.

Batteries

All batteries can cause property damage and/or bodily injury such as burns if a conductive material such as jewelry, keys, or beaded chains touches exposed terminals. The conductive material may complete an electrical circuit (short circuit) and become quite hot. Exercise care in handling any charged battery, particularly when placing it inside a pocket, purse, or other container with metal objects.

Intrinsically Safe Radio Information

FMRC Approved Equipment

Anyone intending to use a radio in a location where hazardous concentrations of flammable materials exist (hazardous atmosphere) is advised to become familiar with the subject of intrinsic safety and with the National Electric Code NFPA 70 (National Fire Protection Association) Article 500 (hazardous [classified] locations).

An Approval Guide, issued by Factory Mutual Research Corporation (FMRC), lists manufacturers and the products approved by FMRC for use in such locations. FMRC has also issued a voluntary approval standard for repair service (“Class Number 3605”).

FMRC Approval labels are attached to the radio to identify the unit as being FM Approved for specified hazardous atmospheres. This label specifies the hazardous Class/Division/Group along with the part number of the battery that must be used. Depending on the design of the portable unit, this FM label can be found on the back or the bottom of the radio housing. The FM Approval mark is shown here.

- **Do not operate radio communications equipment in a hazardous atmosphere unless it is a type especially qualified (for example, FMRC Approved) for such use. An explosion or fire may result.**
- **Do not operate an FMRC Approved Product in a hazardous atmosphere if it has been physically damaged (for example, cracked housing). An explosion or fire may result.**
- **Do not replace or charge batteries in a hazardous atmosphere. Contact sparking may occur while installing or removing batteries and cause an explosion or fire.**
- **Do not replace or change accessories in a hazardous atmosphere. Contact sparking may occur while installing or removing accessories and cause an explosion or fire.**
- **Do not operate an FMRC Approved Product unit in a hazardous location with the accessory contacts exposed. Keep the connector cover in place when accessories are not used.**
- **Turn a radio off before removing or installing a battery or accessory.**
- **Do not disassemble an FMRC Approved Product unit in any way that exposes the internal electrical circuits of the unit.**

Radios must ship from the Motorola manufacturing facility with the hazardous atmosphere capability and FM Approval labeling. Radios will not be “upgraded” to this capability and labeled in the field.

A modification changes the unit’s hardware from its original design configuration. Modifications can only be made by the original product manufacturer at one of its FMRC-audited manufacturing facilities.

- **Failure to use an FMRC Approved Product unit with an FMRC Approved battery or FMRC Approved accessories specifically approved for that product may result in the dangerously unsafe condition of an unapproved radio combination being used in a hazardous location.**
- **Unauthorized or incorrect modification of an FMRC Approved Product unit will negate the Approval rating of the product.**

Repair of FMRC Approved Products

REPAIRS FOR MOTOROLA PRODUCTS WITH FMRC APPROVAL ARE THE RESPONSIBILITY OF THE USER.

You should not repair or relabel any Motorola- manufactured communication equipment bearing the FMRC Approval label (“FMRC Approved Product”) unless you are familiar with the current FMRC Approval standard for repairs and service (“Class Number 3605”).

You may want to consider using a repair facility that operates under 3605 repair service approval.

- **Incorrect repair or relabeling of any FMRC Approved Product unit could adversely affect the Approval rating of the unit.**
- **Use of a radio that is not intrinsically safe in a hazardous atmosphere could result in serious injury or death.**

FMRC’s Approval Standard Class Number 3605 is subject to change at any time without notice to you, so you may want to obtain a current copy of 3605 from FMRC. Per the December 1994 publication of 3605, some key definitions and service requirements are as follows:

Repair

A repair constitutes something done internally to the unit that would bring it back to its original condition—Approved by FMRC. A repair should be done in an FMRC Approved facility.

Items not considered as repairs are those in which an action is performed on a unit which does not require the outer casing of the unit to be opened in a manner which exposes the internal electrical circuits of the unit. You do not have to be an FMRC Approved Repair Facility to perform these actions.

Relabeling

The repair facility shall have a method by which the replacement of FMRC Approval labels are controlled to ensure that any relabeling is limited to units that were originally shipped from the Manufacturer with an FM Approval label in place. FMRC Approval labels shall not be stocked by the repair facility. An FMRC Approval label shall be ordered from the original manufacturer, as needed, to repair a specific unit. Replacement labels may be obtained and applied by the repair facility, provided there is satisfactory evidence that the unit being relabeled was originally an FMRC Approved unit. Verification may include, but is not limited to: a unit with a damaged Approval label, a unit with a defective housing displaying an Approval label, or a customer invoice indicating the serial number of the unit and purchase of an FMRC Approved model.

Do Not Substitute Options or Accessories

The Motorola communications equipment certified by Factory Mutual is tested as a system and consists of the FM Approved portable, FM Approved battery, and FM Approved accessories or options, or both. This FM Approved portable and battery combination must be strictly observed. There must be no substitution of items, even if the substitute has been previously Approved with a different Motorola communications equipment unit. Approved configurations are listed in the FM Approval Guide published by FMRC, or in the product FM Supplement. This FM Supplement is shipped from the manufacturer with the FM Approved radio and battery combination. The Approval Guide, or the Approval Standard Class Number 3605 document for repairs and service, can be ordered directly from Factory Mutual Research Corporation located in Norwood, Massachusetts.

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Table of Contents

Chapter 1 Introduction

1.1 Scope of Manual

This manual is intended for use by service technicians familiar with similar types of equipment. It contains service information required for the equipment described and is current as of the printing date. Changes that occur after the printing date are incorporated by a complete manual revision or alternatively, as additions.

NOTE **Before operating or testing these units, please read the Safety Information Section in the front of this manual.**

1.2 Warranty and Service Support

Motorola offers long term support for its products. This support includes full exchange and/or repair of the product during the warranty period, and service/repair or spare parts support out of warranty. Any “return for exchange” or “return for repair” by an authorized Motorola dealer must be accompanied by a warranty claim form. Warranty claim forms are obtained by contacting customer service.

1.2.1 Warranty Period

The terms and conditions of warranty are defined fully in the Motorola dealer or distributor or reseller contract. These conditions may change from time to time and the following notes are for guidance purposes only.

1.2.2 Return Instructions

In instances where the product is covered under a “return for replacement” or “return for repair” warranty, a check of the product should be performed prior to shipping the unit back to Motorola. This is to ensure that the product has been correctly programmed or has not been subjected to damage outside the terms of the warranty.

Prior to shipping any radio back to a Motorola warranty depot, please contact the appropriate customer service for instructions. All returns must be accompanied by a warranty claim form, available from your customer services representative. Products should be shipped back in the original packaging, or correctly packaged to ensure no damage occurs in transit.

1.2.3 After Warranty Period

After the Warranty period, Motorola continues to support its products in two ways:

Firstly, Motorola's Accessories and Aftermarket Division (ADD) supplies individual parts and modules that can be purchased by dealers who are technically capable of performing fault analysis and repair.

Secondly, Motorola’s service department offers a repair service to both end users and dealers at competitive prices.

1.3 Related Documents

The following documents are directly related to the use and maintainability of this product.

Title	Part Number
Service Manual, Basic, Engl, NA	68P81094C00
Service Manual, Basic, Engl, LA	68P81094C01
Service Manual, Basic, Span	68P81094C02
Service Manual, Basic, Port	68P81094C03
Service Manual, Detailed, Engl	68P81094C21
Service Manual, Detailed, Span	68P81094C22
Service Manual, Detailed, Port	68P81094C23

1.4 Technical Support

Technical support is available to assist the dealer/distributor and self-maintained customers in resolving any malfunction which may be encountered. Initial contact should be by telephone to customer resources wherever possible. When contacting Motorola technical support, be prepared to provide the product model number and the unit's serial number. The contact locations and telephone numbers are located in the Basic Service Manual listed under the Related Documents paragraph of this chapter.

1.4.1 Piece Parts Availability

Some replacement parts, spare parts, and/or product information can be ordered directly. If a complete Motorola part number is assigned to the part, and it is not identified as "Depot ONLY", the part is available from Motorola Accessories and Aftermarket Division (AAD). If no part number is assigned, the part is not normally available from Motorola. If the part number is appended with an asterisk, the part is serviceable by a Motorola depot only. If a parts list is not included, this generally means that no user-serviceable parts are available for that kit or assembly.

Parts Order Entry
7:00 A. M. to 7:00 P. M. (Central Standard Time)
Monday through Friday (Chicago, U. S. A.)

To Order Parts in the United States of America:
1-800-422-4210, or 847-538-8023
1-800-826-1913, or 410-712-6200 (U. S. Federal Government)
TELEX: 280127
FAX: 1-847-538-8198
FAX: 1-410-712-4991 (U. S. Federal Government)
(U. S. A.) after hours or weekends:
1-800-925-4357

To Order Parts in Latin America and the Caribbean:
Please send an email to:
latech1@email.mot.com
Accessories and Aftermarket Division
(United States and Canada)
Attention: Order Processing
1313 E. Algonquin Road
Schaumburg, IL 60196
Accessories and Aftermarket Division
Attention: Latin America and Caribbean

Order Processing
1313 E. Algonquin Road
Schaumburg, IL 60196

Parts Identification
1-847-538-0021 (Voice)
1-847-538-8194 (FAX)

1.5 Radio Model Chart and Specifications

The radio model charts and specifications are located in the Basic Service Manual listed under the Related Documents paragraph of this chapter.

1.6 Radio Model Information

The model number and serial number are located on a label attached to the back of your radio. You can determine the RF output power, frequency band, protocols, and physical packages from these numbers. The example below shows one portable radio model number and its specific characteristics.

Table 1-1. Radio Model Number

Example: LAH38KDC9AA3

	Type of Unit	Model Series	Freq. Band	Power Level	Physical Packages	Channel Spacing	Protocol	Feature Level	Model Revision	Model Package
AA or LA ↑ **LA** = Motorola Internal Use →	**H** ↑ **H** = Portable →	**38**	**K VHF (136-174MHz)**	**D 4-5W**	**C**	**9 Program-mable**	**AA Conven-tional**	**3**	**A**	**N**
			R UHF1 (403-470MHz)							
			S UHF2 (450-527MHz)							

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Chapter 2 Theory of Operation

2.1 Introduction

This section provides a detailed theory of operation for the radio and its components.

2.2 Radio Power Distribution

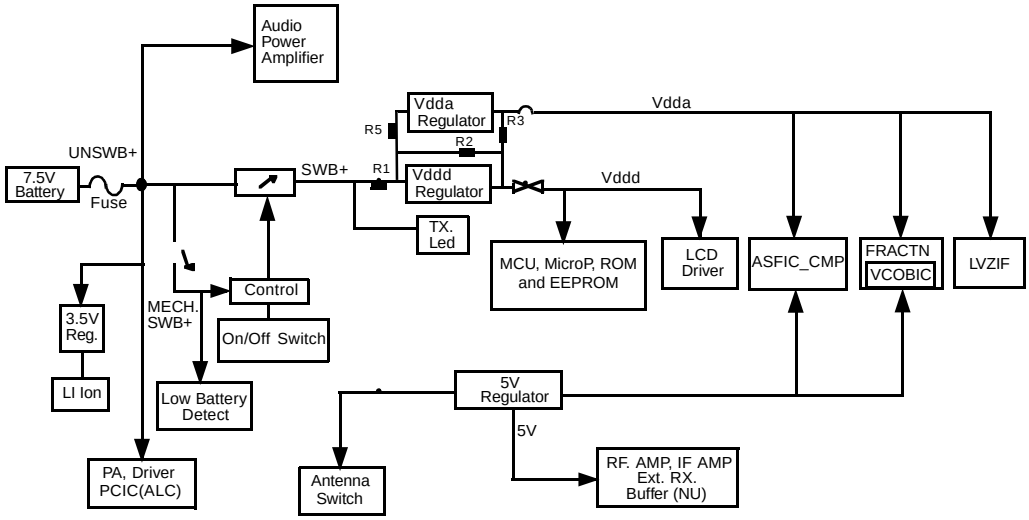

Figure 2-1. DC Power Distribution Block Diagram

A Block diagram of the DC power distribution throughout the radio board is shown in Figure 2-1. A 7.5V battery (BATT 7.5V) supplies power directly to the electronic ON/OFF control as UNSWB+. When the radio is turned on, MECH_SWB+ (ON/OFF volume control) will trigger the electronic ON/OFF control (momentary-on path), then SWB+ is distributed. Vdda from 3.3V Vdda regulator will then supply the microprocessor. Data is then sent to ASFIC_CMP to turn on GCB4(DAC). GCB4 will take over the momentary-on path within 12ms. SWB+ will continue to support the whole board until the radio is turned off.

Radio will be turned-off on two conditions;

1. MECH_SWB+ turned off
2. Low battery

When low battery level is detected by the microprocessor through both conditions above, it will store the radio personality data to EEPROM before turning off.

Table 2-1. Vdd Regulator Band and Radio Jumpers

Jumpers	Dual Vdd Regulator Scheme	Single Vdd Regulator Scheme
R1	**Y**	**Y**
R2	**N**	**N**
R3	**N**	**Y**
R4	**N**	**N**
R5	**Y**	**N**
Vdda	**Y**	**N**
SW. Reg.	**N**	**N**

2.3 Keypad

The keypad block diagram is shown in Figure 2-2. The LED_EN setting is set by the codeplug. When the value is set to high, the LED will not light up during power up and vice versa.

U602 is a comparator that will compare the voltage when any one of the keypad row or keypad column keys is being pressed. Therefore when a key is being pressed, it will send a message to the microprocessor through the output (KEY_INT) telling it that a key has been pressed. The microprocessor will then sample the Analog to Digital voltages at the keypad row and keypad column and map it with the table so that the key being pressed can be identified. Once the key has been identified, the message that corresponds to the key will show up at the display.

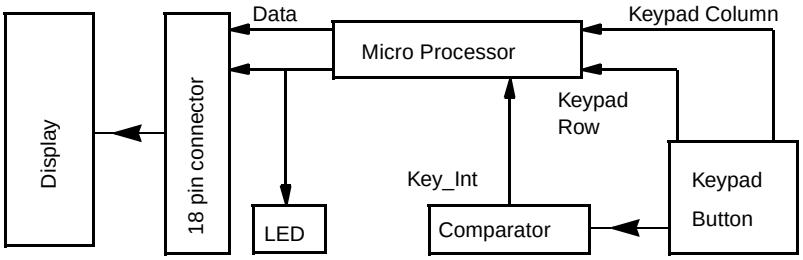

Figure 2-2. Keypad Block Diagram

2.4 Controller Board

The controller board is the central interface between the various subsytems of the radio. It is separated into digital and audio architectures. The digital portion consists of a special Motorola microcontroller (HC11FL0). The audio power amplifier (Audio PA) and audio/signalling/filter/companding IC (ASFIC_CMP) form the backbone of the audio/signalling architecture.

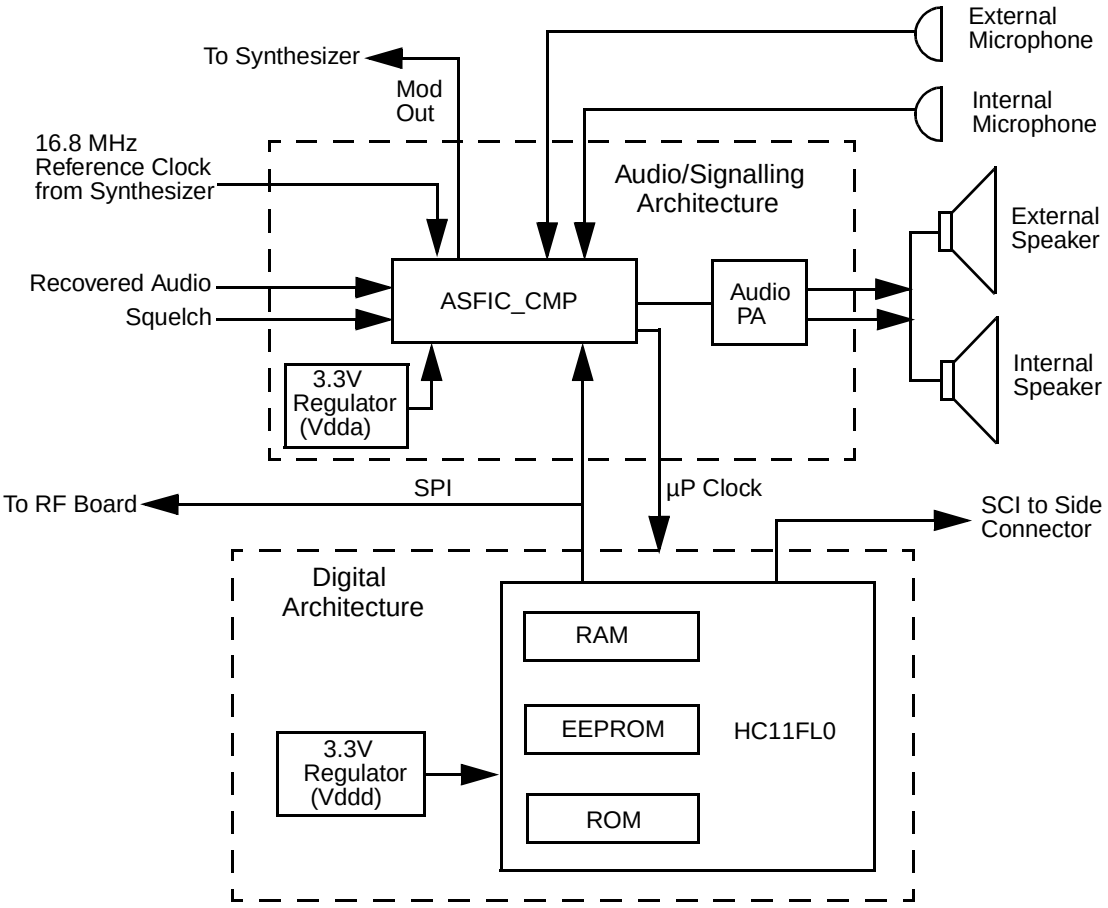

Figure 2-3. Controller Block Diagram

2.4.1 MCU Configuration

There is one common MCU architecture for low-tier as well as for the high-tier products. It covers the Conventional and Trunking portables. An open architecture system with the new HC11FL0 as the processor is used. Combinations of different size RAM, ROM and EEPROM are available for various application software.

2.4.2 Real Time Clock (RTC)

This radio supports Real Time Clock (RTC) module for purposes of Message Time Stamping and Time Keeping. The RTC module resides in the micro-processor HC11FL0. It is kept alive by a back-up Lithium Ion battery when the primary battery is removed.

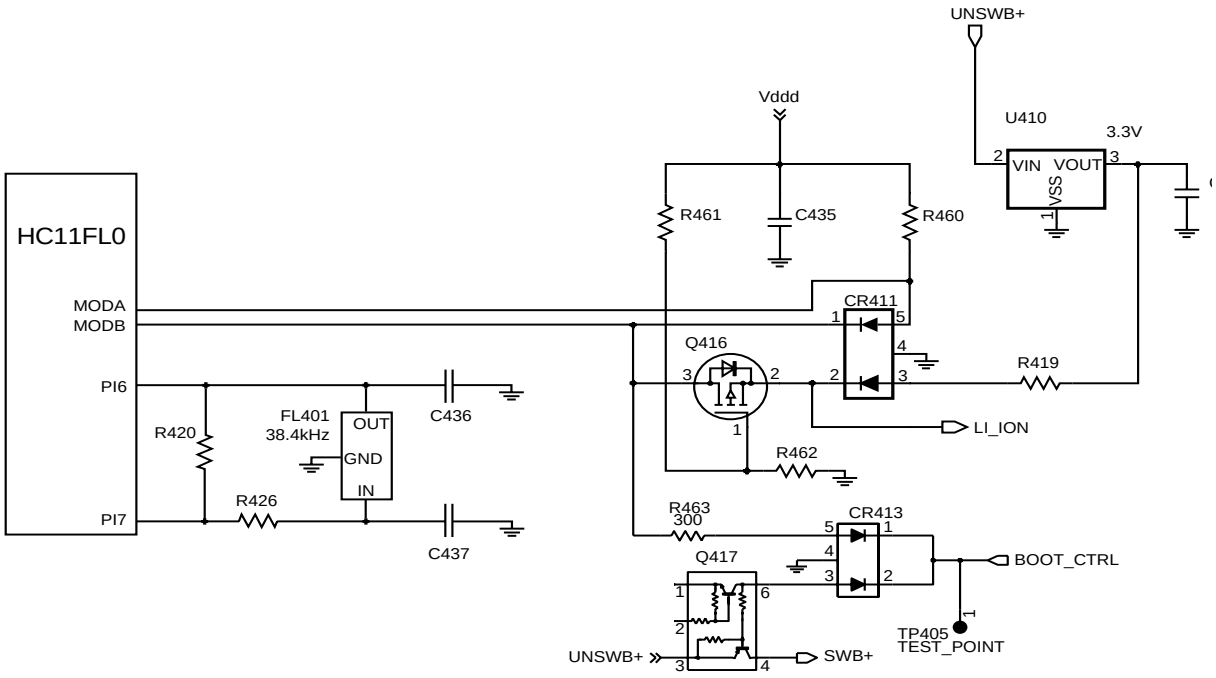

Figure 2-4. RTC Circuit

2.4.3 Circuit Description

The RTC module circuit, shown in Figure 2-4, which resides in the HC11FL0 is powered by the ModB/ Vstby pin and PI6/PI7 form the crystal oscillator circuit. Clock frequency of 38.4kHz from a crystal oscillator provides the reference signal. In the processor, the frequency is divided down to 1Hz.

As the RTC module is powered separately from the processor Vdd, the RTC is kept alive through the ModB / Vstby pin when the radio is switched off. A small button Lithium Ion battery continues to feed the RTC when the primary battery is removed.

A MOSFET Q416 switches in the Li (Lithium) Ion supply when Vdd is removed. Q416 also provides isolation from BOOT_CTRL function in the event of radio program flashing. A small 3.3V regulator is used to charge the Li (Lithium) Ion battery.

2.4.4 ModB/Vstby Supply

The supply to the ModB/Vstby pin varies depending on the conditions listed in Table 2-2

Table 2-2. ModB/Vstby Supply Modes

Condition	Circuit Operation
Radio On	**Vdd supply voltage via CR411**
Radio Off	**• Vdd turned off** **• Q416 gate is pulled low by R462** **• Q416 is switched on** **• U410 supplies 3.2V to ModB/Vstby**
Primary battery removed	**• Vdd turned off** **• Q416 gate is pulled low by R462** **• Q416 is switched on** **• Li Ion battery provides 3.2V to ModB/Vstby**
Flash Mode	**• Boot_Ctrl line pull low** **• ModA & ModB goes low** **• Processor in boot-strap mode** **• Flashing enabled**

2.5 VHF Transmitter

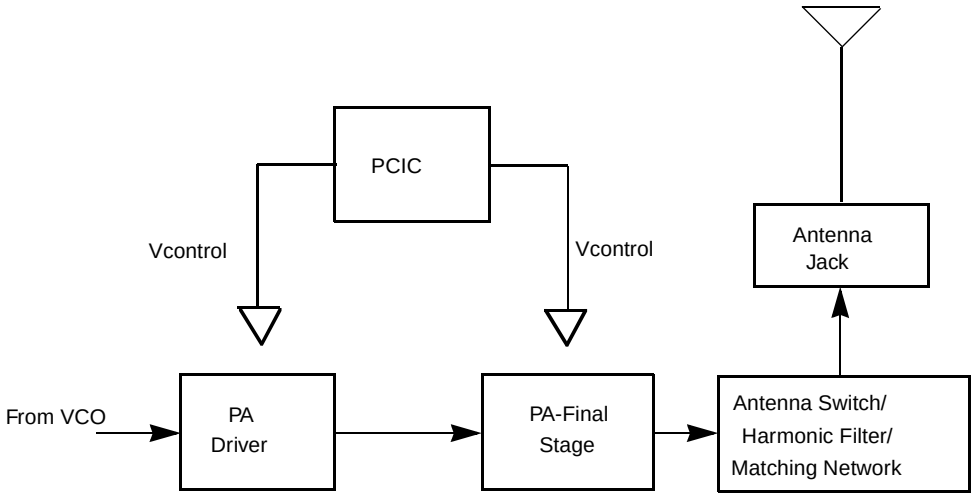

Figure 2-5. Transmitter Block Diagram

The VHF transmitter, shown in Figure 2-5, contains five basic circuits:

- Power Amplifier
- Antenna Switch
- Harmonic Filter
- Antenna Matching Network
- Power Control Integrated Circuit (PCIC).

2.5.1 Power Amplifier

The power amplifier consists of two devices:

- 9Z67 LDMOS driver IC (U3501) and
- PRF1507 LDMOS PA (Q3501).

The 9Z67 LDMOS driver IC contains a 2 stage amplification with a supply voltage of 7.3V.

This RF power amplifier is capable of supplying an output power of 0.3W (pin 6 and 7) with an input signal of 2mW (3dBm) (pin16). The current drain would typically be 130mA while operating in the frequency range of 136-174MHz.

The PRF1507 LDMOS PA is capable of supplying an output power of 7W with an input signal of 0.3W. The current drain would typically be 1800mA while operating in the frequency range of 136-174MHz. The power output can be varied by changing the biasing voltage.

2.5.2 Antenna Switch

The antenna switch circuit consists of two PIN diodes (D3521 and D3551), a pi network (C3531, L3551 and C3550), and three current limiting resistors (R3571, R3572, R3573). In the transmit mode, B+ at PCIC (U3502) pin 23 will go low and turn on Q3561 where a B+ bias is applied to the antenna switch circuit to bias the diodes “on”. The shunt diode (D3551) shorts out the receiver port, and the pi network, which operates as a quarter wave transmission line, transforms the low impedance of the shunt diode to a high impedance at the input of the harmonic filter. In the receive mode, the diodes are both off, and hence, there exists a low attenuation path between the antenna and receiver ports.

2.5.3 Harmonic Filter

The harmonic filter consists of C3532 to C3536, L3531 and L3532. This network forms a low-pass filter to attenuate harmonic energy of the transmitter to specifications level. The harmonic filter insertion loss should be less than 1.2dB.

2.5.4 Antenna Matching Network

A matching network which is made up of L3538 and C3537 is used to match the antenna's impedance to the harmonic filter. This will optimize the performance of the transmitter and receiver into an antenna.

2.5.5 Power Control Integrated Circuit (PCIC)

The transmitter uses the Power Control IC (PCIC), U3502 to control the power output of the radio by maintaining the radio current drain. The current to the final stage of the power module is supplied through R3519 (0.1ohms), which provides a voltage proportional to the current drain. This voltage is then fedback to the Automatic Level Control (ALC) within the PCIC to keep the whole loop stable.

The PCIC has internal digital to analog converters (DACs) which provide the reference voltage of the control loop. The voltage level is controlled by the microprocessor through the data line of the PCIC.

There are resistors and integrators within the PCIC, and external capacitors (C3562, C3563 and C3565) in controlling the transmitter rising and falling time. These are necessary in reducing the power splatter into adjacent channels.

U3503 and its associated circuitry acts as a temperature cut back circuitry. This circuitry provides the necessary voltage to the PCIC to cut the transmitter power when the radio temperature gets too high.

2.5.6 VHF Receiver

The VHF receiver consists of a front end, back end, and automatic gain control circuits. A block diagram of the VHF receiver is shown in Figure 2-6. Detailed descriptions of these features are contained in the paragraphs that follow.

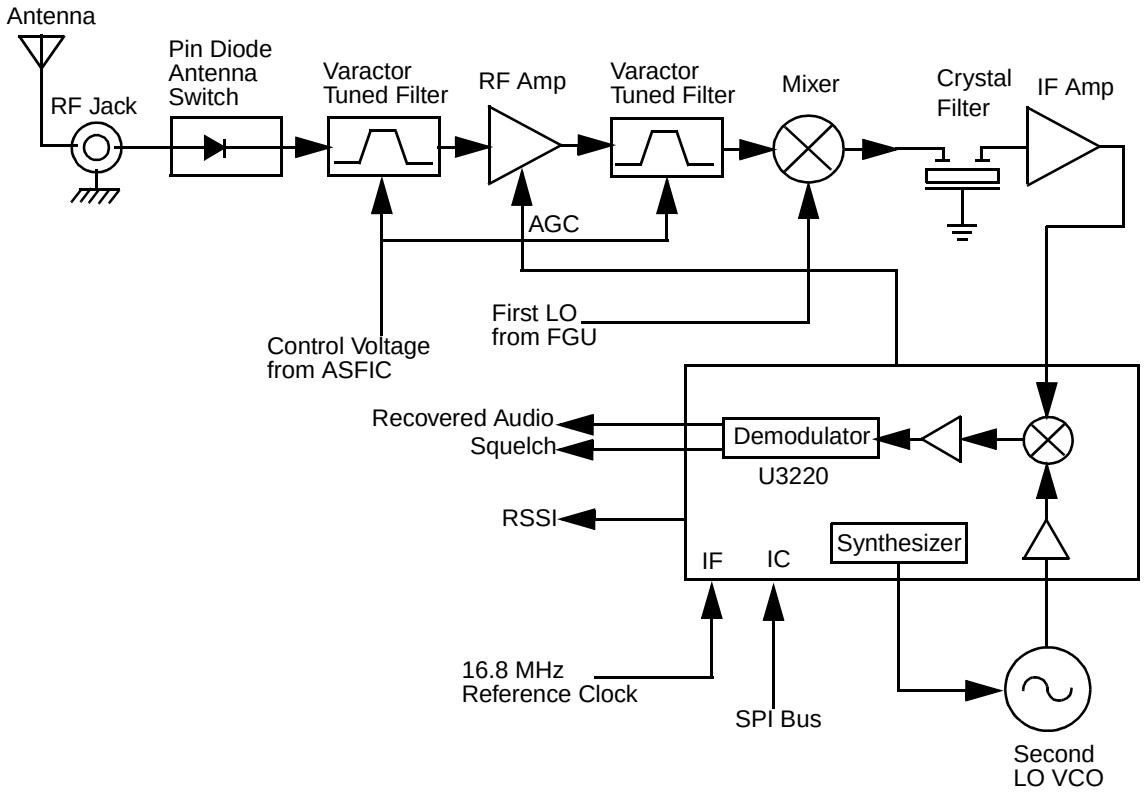

Figure 2-6. VHF Receiver Block Diagram

2.5.7 Receiver Front-End

The RF signal is received by the antenna and applied to a low-pass filter. For VHF, the filter consists of L3531, L3532, C3532 to C3563. The filtered RF signal is passed through the antenna switch. The antenna switch circuit consists of two PIN diodes (D3521 and D3551) and a pi network (C3531, L3551 and C3550). The signal is then applied to a varactor tuned bandpass filter. The VHF bandpass filter comprises of L3301, L3303, C3301 to C3304 and D3301. The bandpass filter is tuned by applying a control voltage to the varactor diode (D3301) in the filter.

The bandpass filter is electronically tuned by the DACRx from IC404 which is controlled by the microprocessor. Depending on the carrier frequency, the DACRx will supply the tuned voltage to the varactor diodes in the filter. Wideband operation of the filter is achieved by shifting the bandpass filter across the band.

The output of the bandpass filter is coupled to the RF amplifier transistor Q3302 via C3306. After being amplified by the RF amplifier, the RF signal is further filtered by a second varactor tuned bandpass filter, consisting of L3305, L3306, C3311 to C3314 and D3302.

Both the pre and post-RF amplifier varactor tuned filters have similar responses. The 3 dB bandwidth of the filter is about 12 MHz. This enables the filters to be electronically controlled by using a single control voltage which is DACRx.

The output of the post-RF amplifier filter is connected to the passive double balanced mixer which consists of T3301, T3302 and CR3301. Matching of the filter to the mixer is provided by C3317, C3318 and L3308. After mixing with the first LO signal from the voltage controlled oscillator (VCO) using high side injection, the RF signal is down-converted to the 45.1 MHz IF signal.

The IF signal coming out of the mixer is transferred to the crystal filter (Y3200) through a resistor pad (R3321 - R3323) and a diplexer (C3320 and L3309). Matching to the input of the crystal filter is provided by C3200 and L3200. The crystal filter provides the necessary selectivity and intermodulation protection.

2.5.8 Receiver Back-End

The output of crystal filter Y3200 is matched to the input of IF amplifier transistor Q3200 by capacitor C3203. Voltage supply to the IF amplifier is taken from the receive 5 volts (R5). The gain controlled IF amplifier provides a maximum gain of about 10dB. The amplified IF signal is then coupled into U3220 (pin 3) via L3202, C3207, and C3230 which provides the matching for the IF amplifier and U3220.

The IF signal applied to pin 3 of U3220 is amplified, down-converted, filtered, and demodulated, to produce the recovered audio at pin 27 of U3220. This IF IC is electronically programmable, and the amount of filtering (which is dependent on the radio channel spacing) is controlled by the microprocessor. Additional filtering, once externally provided by the conventional ceramic filters, is replaced by internal filters in the IF module (U3220).

The IF IC uses a type of direct conversion process, whereby the externally generated second LO frequency is divided by two in U3220 so that it is very close to the first IF frequency. The IF IC (U3220) synthesizes the second LO and phase-locks the VCO to track the first IF frequency. The second LO is designed to oscillate at twice the first IF frequency because of the divide-by-two function in the IF IC.

In the absence of an IF signal, the VCO will “search” for a frequency, or its frequency will vary close to twice the IF frequency. When an IF signal is received, the VCO will lock onto the IF signal. The second LO/VCO is a Colpitts oscillator built around transistor Q3270. The VCO has a varactor diode, D3270, to adjust the VCO frequency. The control signal for the varactor is derived from a loop filter consisting of C3278 to C3280, R3274 and R3275.

The IF IC (U3220) also performs several other functions. It provides a received signal-strength indicator (RSSI) and a squelch output. The RSSI is a dc voltage monitored by the microprocessor, and used as a peak indicator during the bench tuning of the receiver front-end varactor filter. The RSSI voltage is also used to control the automatic gain control (AGC) circuit at the front-end.

The demodulated signal on pin 27 of U3220 is also used for squelch control. The signal is routed to U404 (ASFIC) where squelch signal shaping and detection takes place. The demodulated audio signal is also routed to U404 for processing before going to the audio amplifier for amplification.

2.5.9 Automatic Gain Control Circuit

The front end automatic gain control circuit provides automatic reduction of gain, of the front end RF amplifier via feedback. This action is necessary to prevent overloading of back end circuits. This is achieved by drawing some of the output power from the RF amplifier output. At high radio frequencies, capacitor C3327 provides the low impedance path to ground for this purpose. CR3302 is a PIN diode used for switching the path on or off. A certain amount of forward biasing current is needed to turn the PIN diode on. Transistor Q3301 provides this current.

Radio signal strength indicator, RSSI, a voltage signal, is used to drive Q3301 to saturation i.e. turned on. RSSI is produced by U3220 and is proportional to the gain of the RF amplifier and the input power to the radio.

Resistors R3304 and R3305 are voltage dividers designed to turn on Q3301 at certain RSSI levels. In order to turn on Q3301 the voltage across R3305 must be greater or equal to the voltage across R3324, plus the base-emitter voltage (Vbe) present at Q3301. Capacitor C3209 is used to dampen any instability while the AGC is turning on. The current flowing into the collector of Q3301, a high current gain NPN transistor, will be drawn through the PIN diode to turn it on. Maximum current flowing through the PIN is limited by the resistors R3316, R3313, R3306 and R3324. C3326 is a feedback capacitor used to provide some stability to this high gain stage.

An additional gain control circuit is formed by Q3201 and its associated circuitry. Resistors R3206 and R3207 are voltage dividers designed to turn on Q3201 at a significantly higher RSSI level than the level required to turn on PIN diode control transistor Q3301. In order to turn on Q3201 the voltage across R3207 must be greater or equal to the voltage across R3208, plus the base-emitter voltage (Vbe) present at Q3201. As current starts flowing into the collector of Q3201, it reduces the bias voltage at the base of IF amplifier transistor Q3200 and in turn, the gain of the IF amplifier. The gain can be controlled in a range of -30dB up to +10dB.

2.5.10 Frequency Generation Circuitry

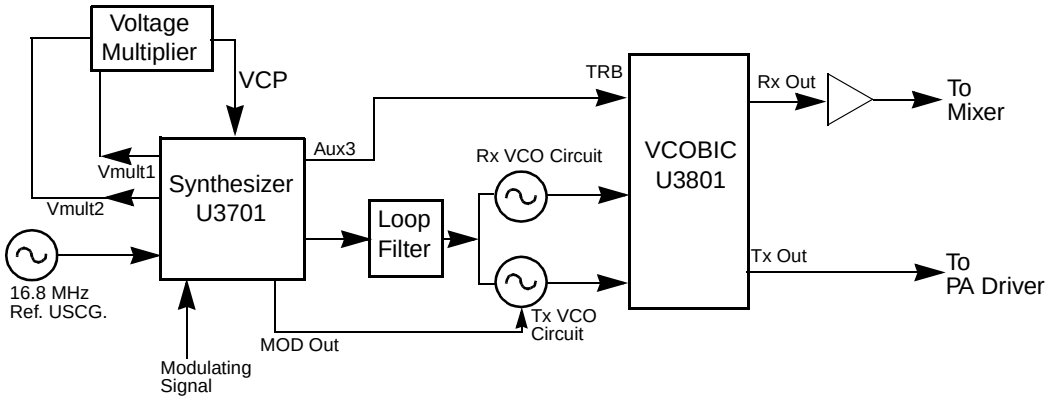

Figure 2-7. Frequency Generation Unit Block Diagram

The Frequency Generation Circuitry, shown in Figure 2-7, is composed of two main ICs, the Fractional-N synthesizer (U3701), and the VCO/Buffer IC (U3801). Designed in conjunction to maximize compatibility, the two ICs provide many of the functions that normally would require additional circuitry. The synthesizer block diagram illustrates the interconnect and support circuitry used in the region. Refer to the relevant schematics for the reference designators.

The synthesizer is powered by regulated 5V and 3.3V which come from U3711 and U3201 respectively. The synthesizer in turn generates a superfiltered 4.5V which powers U3801.

In addition to the VCO, the synthesizer must interface with the logic and ASFIC circuitry. Programming for the synthesizer is accomplished through the data, clock and chip select lines from the microprocessor. A 3.3V dc signal from synthesizer lock detect line indicates to the microprocessor that the synthesizer is locked.

Transmit modulation from the ASFIC is supplied to pin 10 of U3701. Internally the audio is digitized by the Fractional-N and applied to the loop divider to provide the low-port modulation. The audio runs through an internal attenuator for modulation balancing purposes before going out to the VCO.

2.5.11 Synthesizer

The Fractional-N Synthesizer, shown in Figure 2-8, uses a 16.8MHz crystal (Y3761) to provide a reference for the system. The LVFractN IC (U3701) further divides this to 2.1MHz, 2.225MHz, and 2.4MHz as reference frequencies. Together with C3761, C3762, C3763, R3761 and D3761, they build up the reference oscillator which is capable of 2.5ppm stability over temperatures of -30 to 85°C. It also provides 16.8MHz at pin 19 of U3701 to be used by ASFIC and LVZIF.

The loop filter which consist of C3721, C3722, R3721, R3722 and R3723 provides the necessary dc steering voltage for the VCO and determines the amount of noise and spur passing through.

In achieving fast locking for the synthesizer, an internal adapt charge pump provides higher current at pin 45 of U3701 to put synthesizer within the lock range. The required frequency is then locked by normal mode charge pump at pin 43.

Both the normal and adapt charge pumps get their supply from the capacitive voltage multiplier which is made up of C3701 to C3704 and triple diodes D3701, D3702. Two 3.3V square waves (180 deg out of phase) are first multiplied by four and then shifted, along with regulated 5V, to build up 13.5V at pin 47 of U3701.

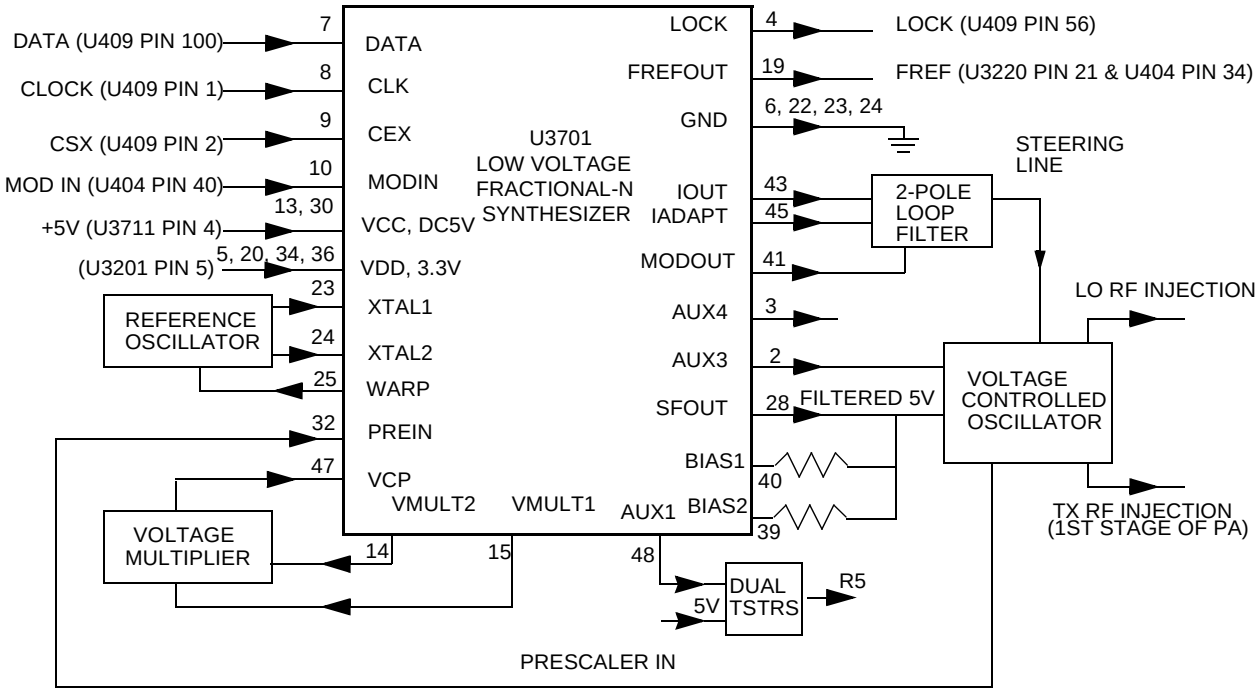

Figure 2-8. Synthesizer Block Diagram

2.5.12 Voltage Controlled Oscillator (VCO)

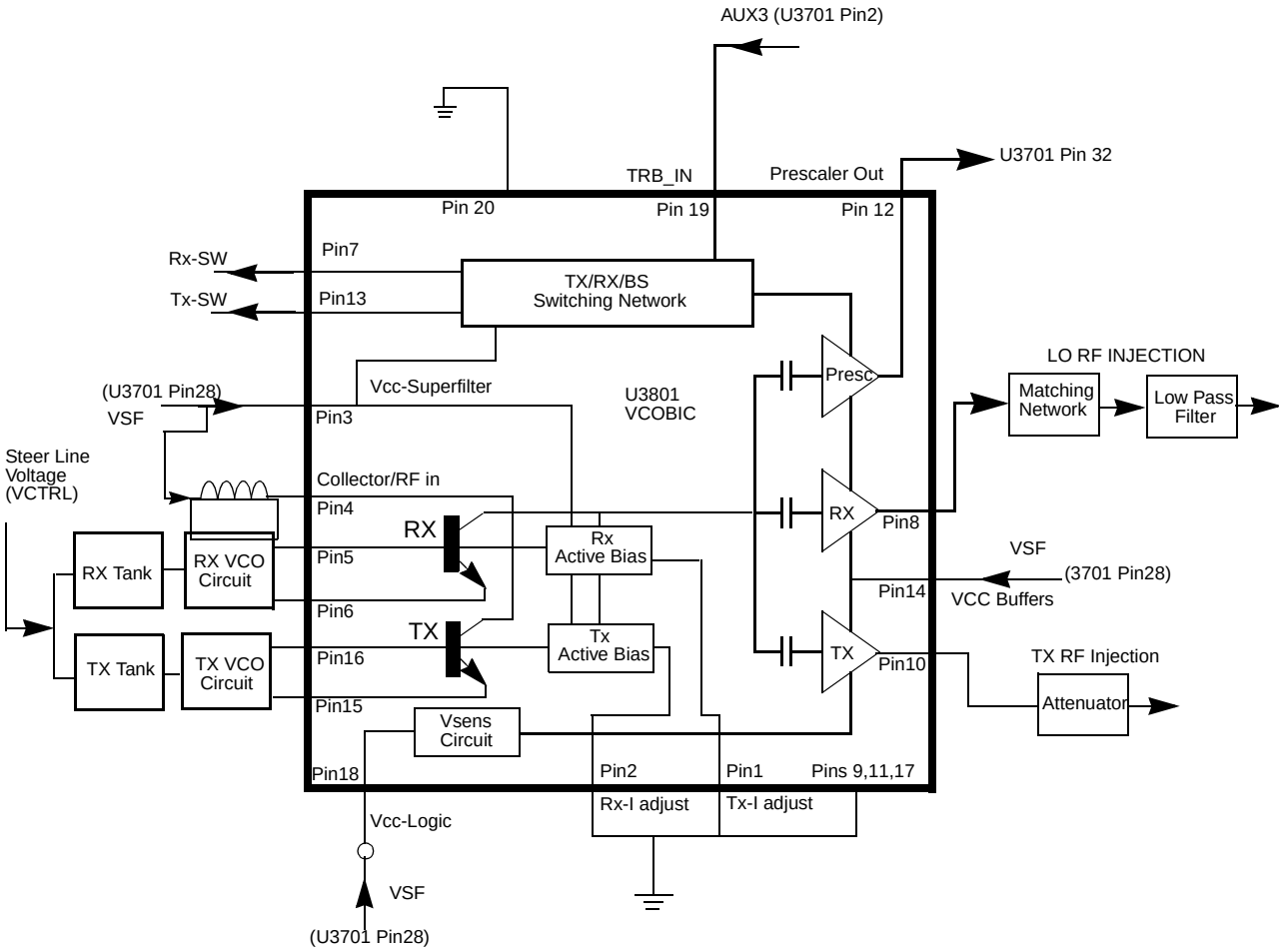

Figure 2-9. VCO Block Diagram

The VCOBIC (U3801), shown in Figure 2-9, in conjunction with the Fractional-N synthesizer (U3701) generates RF in both the receive and the transmit modes of operation. The TRB line (U3801 pin 19) determines which oscillator and buffer will be enabled. A sample of the RF signal from the enabled oscillator is routed from U3801 pin 12, through a low pass filter, to the prescaler input (U3701 pin 32). After frequency comparison in the synthesizer, a resultant CONTROL VOLTAGE is received at the VCO. This voltage is a DC voltage typically between 3.5V and 9.5V when the PLL is locked on frequency.

The RF section of the VCOBIC (U3801) is operated at 4.54 V (VSF), while the control section of the VCOBIC and Fractional-N synthesizer (U3701) is operated at 3.3V. The operation logic is shown in Table 2-3.

Table 2-3. VCO Control Logic

Desired Mode	AUX 4	AUX 3	TRB
Tx	**n.u.**	**High (@3.2V)**	**High (@3.2V)**
Rx	**n.u.**	**Low**	**Low**
Battery Saver	**n.u.**	**Hi-Z/Float (@1.6V)**	**Hi-Z/Float (@1.6V)**

In the receive mode, U3801 pin 19 is low or grounded. This activates the receive VCO by enabling the receive oscillator and the receive buffer of U3801. The RF signal at U3801 pin 8 is run through a matching network. The resulting RF signal is the LO RF INJECTION and it is applied to the mixer at T3302.

During the transmit condition, when PTT is depressed, 3.2 volts is applied to U3801 pin 19. This activates the transmit VCO by enabling the transmit oscillator and the transmit buffer of U3801. The RF signal at U3801 pin 10 is injected into the input of the PA module (U3501 pin16). This RF signal is the TX RF INJECTION. Also in transmit mode, the audio signal to be frequency modulated onto the carrier is received through U3701 pin 41.

When a high impedance is applied to U3801 pin19, the VCO is operating in BATTERY SAVER mode. In this case, both the receive and transmit oscillators as well as the receive transmit and prescaler buffer are turned off.

2.6 UHF Transmitter (Band 1 and Band 2)

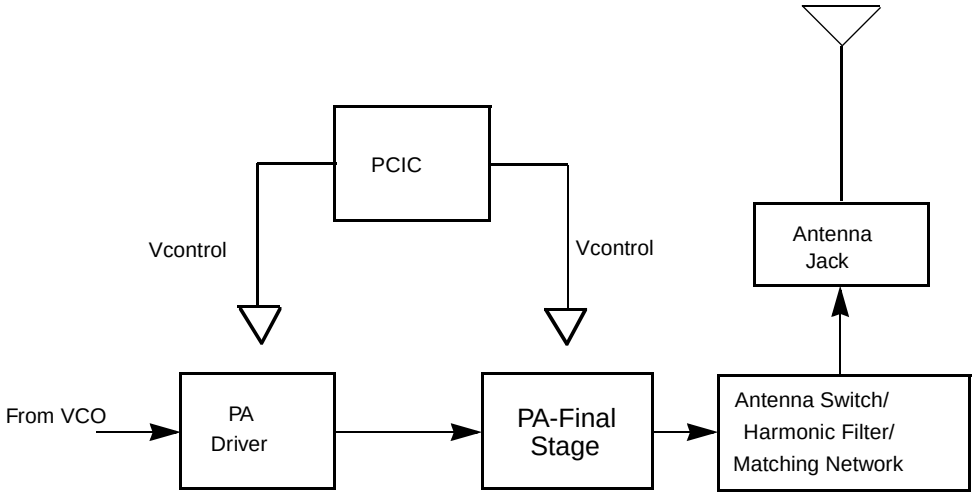

Figure 2-10. Transmitter Block Diagram

The UHF transmitter consists of the following basic circuits as shown in Figure 2-10:

- Power Amplifier
- Antenna Switch
- Harmonic Filter
- Antenna Matching Network
- Power Control Integrated Circuit (PCIC).

2.6.1 Power Amplifier

The power amplifier consists of two devices:

- 9Z67 LDMOS driver IC (U101) and
- PRF1507 LDMOS PA (Q110).

The 9Z67 LDMOS driver IC contains a 2 stage amplification with a supply voltage of 7.3V.

This RF power amplifier is capable of supplying an output power of 0.3W (pins 6 and 7) with an input signal of 2mW (3dBm) (pin 16). The current drain would typically be 160mA while operating in the frequency range of 403-470MHz for Band 1 or 450-527MHz for Band 2.

The PRF1507 LDMOS PA is capable of supplying an output power of 7W with an input signal of 0.3W. The current drain would typically be 1300mA while operating in the frequency range of 403-470MHz for Band 1 or 450-527MHz for Band 2. The power output can be varied by changing the biasing voltage.

2.6.2 Antenna Switch

The antenna switch circuit consists of two PIN diodes (CR101 and CR102), a pi network (C107, L104 and C106), and two current limiting resistors (R101, R170). In the transmit mode, B+ at PCIC (U102) pin 23 will go low and turn on Q111 where a B+ bias is applied to the antenna switch circuit to bias the diodes “on”. The shunt diode (CR102) shorts out the receiver port, and the pi network, which operates as a quarter wave transmission line, transforms the low impedance of the shunt diode to a high impedance at the input of the harmonic filter. In the receive mode, the diodes are both off, and hence, there exists a low attenuation path between the antenna and receiver ports.

2.6.3 Harmonic Filter

The harmonic filter consists of C104, L102, C103, L101 and C102. The design of the harmonic filter for UHF is that of a modified Zolotarev design. It has been optimized for efficiency of the power module. This type of filter has the advantage that it can give a greater attenuation in the stop-band for a given ripple level. The harmonic filter insertion loss is typically less than 1.2dB.

2.6.4 Antenna Matching Network

A matching network which is made up of L116 is used to match the antenna's impedance to the harmonic filter. This will optimize the performance of the transmitter and receiver into an antenna.

2.6.5 Power Control Integrated Circuit (PCIC)

The transmitter uses the Power Control IC (PCIC), U102 to regulate the power output of the radio. The current to the final stage of the power module is supplied through R101, which provides a voltage proportional to the current drain. This voltage is then fedback to the Automatic Level Control (ALC) within the PCIC to regulate the output power of the transmitter.

The PCIC has internal digital to analog converters (DACs) which provide the reference voltage of the control loop. The reference voltage level is programmable through the SPI line of the PCIC.

There are resistors and integrators within the PCIC, and external capacitors (C133, C134 and C135) in controlling the transmitter rising and falling time. These are necessary in reducing the power splatter into adjacent channels.

CR105 and its associated components are part of the temperature cut back circuitry. It senses the printed circuit board temperature around the transmitter circuits and output a DC voltage to the PCIC. If the DC voltage produced exceeds the set threshold in the PCIC, the transmitter output power will be reduced so as to reduce the transmitter temperature.

2.6.6 UHF Receiver (Band 1 and Band 2)

The UHF receiver consists of a front end, back end, and automatic gain control circuits. a block diagram of the receiver is shown in Figure 2-11.

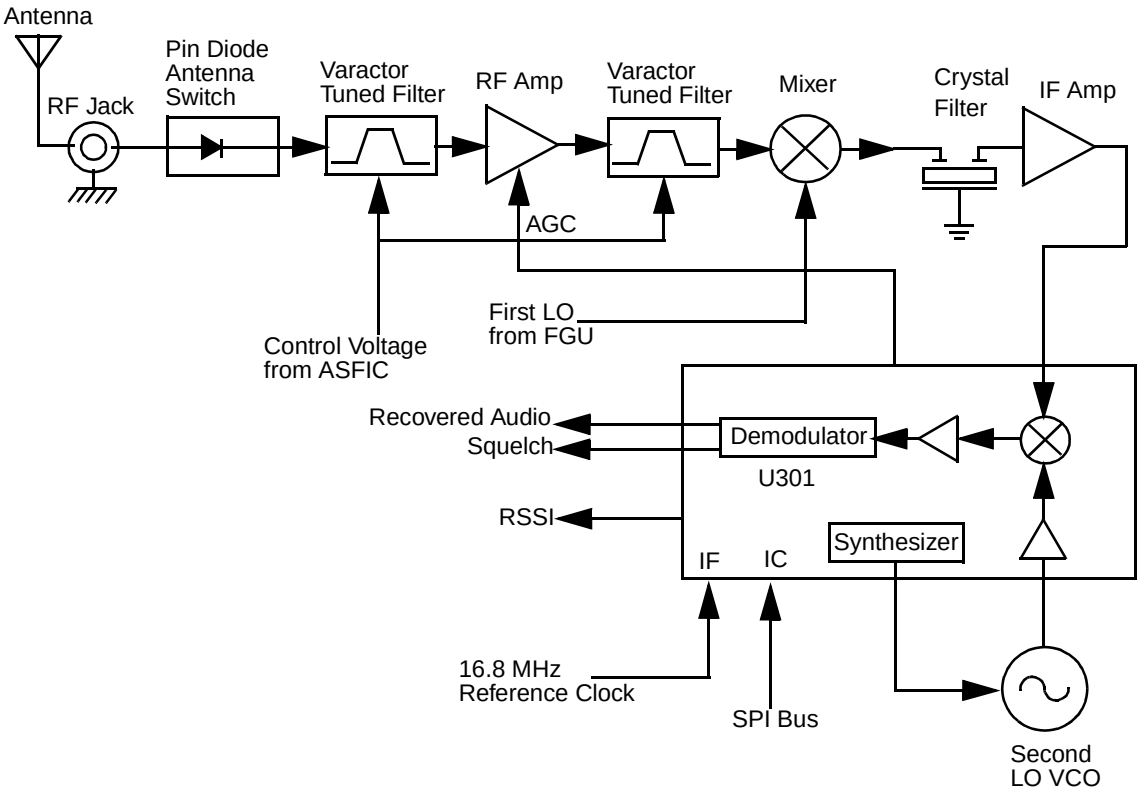

Figure 2-11. UHF Receiver Block Diagram

A detailed description of these stages are contained in the paragraphs that follow.

2.6.7 Receiver Front-End

The RF signal is received by the antenna and applied to a low-pass filter. For UHF, the filter consists of L101, L102, C102, C103, C104. The filtered RF signal is passed through the antenna switch. The antenna switch circuit consists of two PIN diodes (CR101 and CR102) and a pi network (C106, L104 and C107).The signal is then applied to a varactor tuned bandpass filter. The UHF bandpass filter comprises of L301, L302, C302, C303, C304, CR301 and CR302. The bandpass filter is tuned by applying a control voltage to the varactor diodes (CR301 and CR302) in the filter.

The bandpass filter is electronically tuned by the DACRx from IC404 which is controlled by the microprocessor. Depending on the carrier frequency, the DACRx will supply the tuned voltage to the varactor diodes in the filter. Wideband operation of the filter is achieved by shifting the bandpass filter across the band.

The output of the bandpass filter is coupled to the RF amplifier transistor Q301 via C307. After being amplified by the RF amplifier, the RF signal is further filtered by a second varactor tuned bandpass filter, consisting of L306, L307, C313, C317, CR304 and CR305.

Both the pre and post-RF amplifier varactor tuned filters have similar responses. The 3dB bandwidth of the filter is about 50MHz. This enables the filters to be electronically controlled by using a single control voltage which is DACRx.

The output of the post-RF amplifier filter which is connected to the passive double balanced mixer consists of T301, T302 and CR306. Matching of the filter to the mixer is provided by C381. After mixing with the first LO signal from the voltage controlled oscillator (VCO) using low side injection, the RF signal is down-converted to the 45.1MHz IF signal.

The IF signal coming out of the mixer is transferred to the crystal filter (FL301) through a resistor pad and a diplexer (C322 and L310). Matching to the input of the crystal filter is provided by C324 and L311. The crystal filter provides the necessary selectivity and intermodulation protection.

2.6.8 Receiver Back-End

The output of crystal filter FL301 is matched to the input of IF amplifier transistor Q302 by components R352 and C325. Voltage supply to the IF amplifier is taken from the receive 5 volts (R5). The IF amplifier provides a gain of about 7dB. The amplified IF signal is then coupled into U301 (pin 3) via C330, C338 and L330 which provides the matching for the IF amplifier and U301.

The IF signal applied to pin 3 of U301 is amplified, down-converted, filtered, and demodulated, to produce the recovered audio at pin 27 of U301. This IF IC is electronically programmable, and the amount of filtering (which is dependent on the radio channel spacing) is controlled by the microprocessor. Additional filtering, once externally provided by the conventional ceramic filters, is replaced by internal filters in the IF module (U301).

The IF IC uses a type of direct conversion process, whereby the externally generated second LO frequency is divided by two in U301 so that it is very close to the first IF frequency. The IF IC (U301) synthesizes the second LO and phase-locks the VCO to track the first IF frequency. The second LO is designed to oscillate at twice the first IF frequency because of the divide-by-two function in the IF IC.

In the absence of an IF signal, the VCO will “search” for a frequency, or its frequency will vary close to twice the IF frequency. When an IF signal is received, the VCO will lock onto the IF signal. The second LO/VCO is a Colpitts oscillator built around transistor Q320. The VCO has a varactor diode, CR310, to adjust the VCO frequency. The control signal for the varactor is derived from a loop filter consisting of C362, C363, C364, R320 and R321.

The IF IC (U301) also performs several other functions. It provides a received signal-strength indicator (RSSI) and a squelch output. The RSSI is a DC voltage monitored by the microprocessor, and used as a peak indicator during the bench tuning of the receiver front-end varactor filter. The RSSI voltage is also used to control the automatic gain control (AGC) circuit at the front-end.

The demodulated signal on pin 27 of U301 is also used for squelch control. The signal is routed to U404 (ASFIC) where squelch signal shaping and detection takes place. The demodulated audio signal is also routed to U404 for processing before going to the audio amplifier for amplification.

2.6.9 Automatic Gain Control Circuit

The front end automatic gain control circuit is to provide automatic gain reduction of the front end RF amplifier via feedback. This action is necessary to prevent overloading of back end circuits. This is achieved by drawing some of the output power from the RF amplifier’s output. At high radio frequencies, capacitor C331 provides the low impedance path to ground for this purpose. CR308 is a PIN diode used for switching the path on or off. A certain amount of forward biasing current is needed to turn the PIN diode on. Transistors Q315 provides this current where upon saturation, current will flow via R347, PIN diode, collector and emitter of Q315 and R319 before going to ground. Q315 is an NPN transistor used for switching here. Maximum current flowing through the PIN is mainly limited by the resistor R319.

Radio signal strength indicator, RSSI, a voltage signal, is used to drive Q315 to saturation hence turning it on. RSSI is produced by U301 and is proportional to the gain of the RF amplifier and the input RF signal power to the radio.

Resistor network at the input to the base of Q315 is scaled to turn on Q315, hence activating the AGC, at certain RSSI levels. In order to turn on Q315, the voltage across the transistor's base to ground must be greater or equal to the voltage across R319, plus the base-emitter voltage (Vbe) present at Q315. The resistor network with thermistor RT300 is capable of providing temperature compensation to the AGC circuit, as RSSI generated by U301 is lower at cold temperatures compared to normal operation at room temperature. Resistor R300 and capacitor C397 form an R-C network used to dampen any transient instability while the AGC is turning on.

2.6.10 Frequency Generation Circuitry

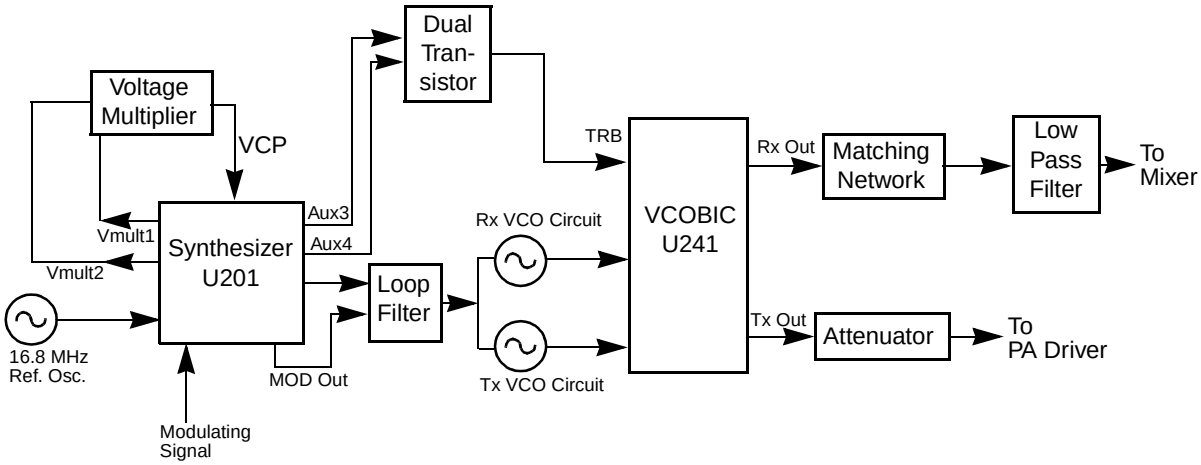

Figure 2-12. Frequency Generation Unit Block Diagram

The Frequency Generation Circuitry is composed of two main ICs, the Fractional-N synthesizer (U201), and the VCO/Buffer IC (U241). Designed in conjunction to maximize compatibility, the two ICs provide many of the functions that normally would require additional circuitry. The synthesizer block diagram illustrates the interconnect and support circuitry used in the region. Refer to the relevant schematics for the reference designators.

The synthesizer is powered by regulated 5V and 3.3V which come from U247 and U248 respectively. The synthesizer in turn generates a superfiltered 4.5V which powers U241.

In addition to the VCO, the synthesizer must interface with the logic and ASFIC circuitry. Programming for the synthesizer is accomplished through the data, clock and chip select lines from the microprocessor. A 3.3V dc signal from synthesizer lock detect line indicates to the microprocessor that the synthesizer is locked.

Transmit modulation from the ASFIC is supplied to pin10 of U201. Internally the audio is digitized by the Fractional-N and applied to the loop divider to provide the low-port modulation. The audio runs through an internal attenuator for modulation balancing purposes before going out to the VCO.

2.6.11 Synthesizer

The Fractional-N Synthesizer uses a 16.8MHz crystal (FL201) to provide a reference for the system. The LVFractN IC (U201) further divides this to 2.1MHz, 2.225MHz, and 2.4MHz as reference frequencies. Together with C206, C207, C208, R204 and CR203, they build up the reference oscillator which is capable of 2.5ppm stability over temperatures of -30 to 85°C. It also provides 16.8MHz at pin 19 of U201 to be used by ASFIC and LVZIF.

The loop filter which consist of C231, C232, C233, R231, R232 and R233 provides the necessary DC steering voltage for the VCO and determines the amount of noise and spur passing through.

In achieving fast locking for the synthesizer, an internal adapt charge pump provides higher current at pin 45 of U201 to put synthesizer within the lock range. The required frequency is then locked by normal mode charge pump at pin 43.

Both the normal and adapt charge pumps get their supply from the capacitive voltage multiplier which is made up of C258, C259, C228, triple diode CR201 and level shifters U210 and U211. Two 3.3V square waves (180 deg out of phase) are first shifted to 5V, then along with regulated 5V, put through arrays of diodes and capacitors to build up 13.3V at pin 47 of U201.

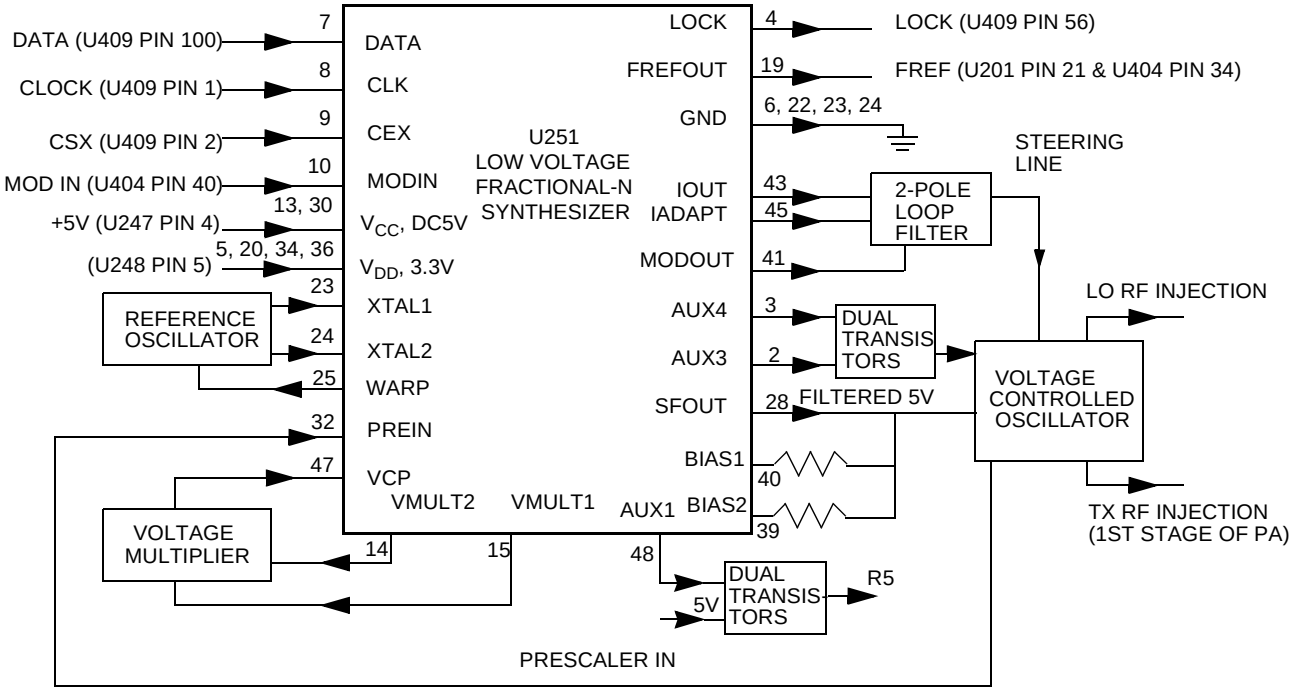

Figure 2-13. Synthesizer Block Diagram

2.6.12 Voltage Controlled Oscillator - (VCO)

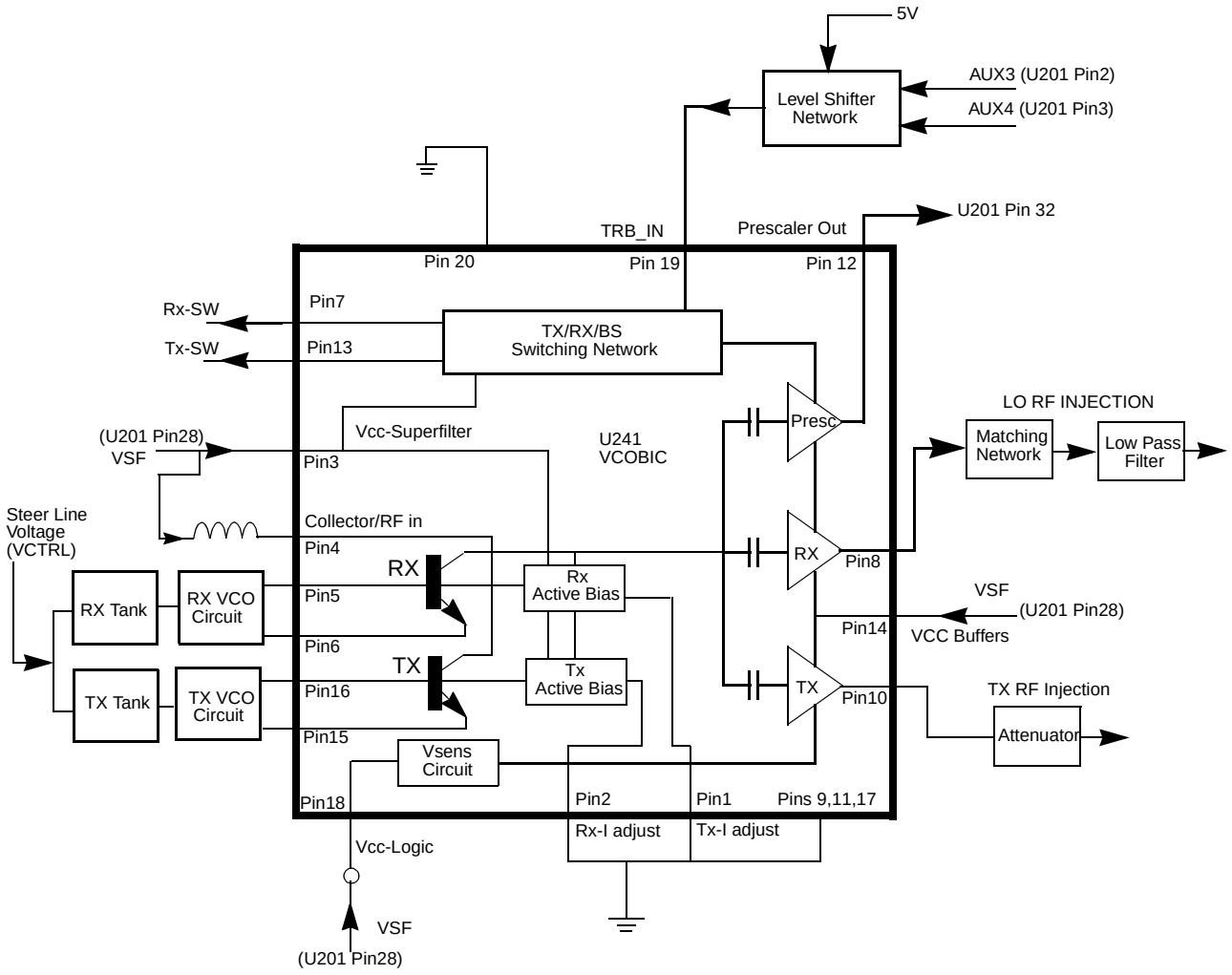

Figure 2-14. VCO Block Diagram

The VCOBIC (U241) in conjunction with the Fractional-N synthesizer (U201) generates RF in both the receive and the transmit modes of operation. The TRB line (U241 pin 19) determines which oscillator and buffer will be enabled. A sample of the RF signal from the enabled oscillator is routed from U241 pin 12, through a low pass filter, to the prescaler input (U201 pin 32). After frequency comparison in the synthesizer, a resultant CONTROL VOLTAGE is received at the VCO. This voltage is a DC voltage between 3.5V and 9.5V when the PLL is locked on frequency.

The VCOBIC(U241) is operated at 4.54V (VSF) and Fractional-N synthesizer (U201) at 3.3V. This difference in operating voltage requires a level shifter consisting of Q260 and Q261 on the TRB line.

The operation logic is shown in Table 2-4.

Table 2-4. Level Shifter Logic

Desired Mode	AUX 4	AUX 3	TRB
Tx	**Low**	**High (@3.2V)**	**High (@4.8V)**
Rx	**High**	**Low**	**Low**
Battery Saver	**Low**	**Low**	**Hi-Z/Float (@2.5V)**

In the receive mode, U241 pin 19 is low or grounded. This activates the receive VCO by enabling the receive oscillator and the receive buffer of U241. The RF signal at U241 pin 8 is run through a matching network. The resulting RF signal is the LO RF INJECTION and it is applied to the mixer at T302.

During the transmit condition, when PTT is depressed, five volts is applied to U241 pin 19. This activates the transmit VCO by enabling the transmit oscillator and the transmit buffer of U241. The RF signal at U241 pin 10 is injected into the input of the PA module (U101 pin16). This RF signal is the TX RF INJECTION. Also in transmit mode, the audio signal to be frequency modulated onto the carrier is received through the U201 pin 41.

When a high impedance is applied to U241 pin19, the VCO is operating in BATTERY SAVER mode. In this case, both the receive and transmit oscillators as well as the receive transmit and prescaler buffer are turned off.

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Chapter 3 Maintenance

3.1 Introduction

This chapter of the manual describes:

- Preventive maintenance
- Safe handling of CMOS devices
- Repair procedures and techniques

3.2 Preventive Maintenance

The radios do not require a scheduled preventive maintenance program; however, periodic visual inspection and cleaning is recommended.

3.2.1 Inspection

Check that the external surfaces of the radio are clean, and that all external controls and switches are functional. It is not recommended to inspect the interior electronic circuitry.

3.2.2 Cleaning

The following procedures describe the recommended cleaning agents and the methods to be used when cleaning the external and internal surfaces of the radio. External surfaces include the front cover, housing assembly, and battery case. These surfaces should be cleaned whenever a periodic visual inspection reveals the presence of smudges, grease, and/or grime.

NOTE **Internal surfaces should be cleaned only when the radio is disassembled for servicing or repair.**

The only recommended agent for cleaning the external radio surfaces is a 0.5% solution of a mild dishwashing detergent in water. The only factory recommended liquid for cleaning the printed circuit boards and their components is isopropyl alcohol (70% by volume).

CAUTION: The effects of certain chemicals and their vapors can have harmful results on certain plastics. Aerosol sprays, tuner cleaners, and other chemicals should be avoided.

1. **Cleaning External Plastic Surfaces**
   The detergent-water solution should be applied sparingly with a stiff, non-metallic, short-bristled brush to work all loose dirt away from the radio. A soft, absorbent, lintless cloth or tissue should be used to remove the solution and dry the radio. Make sure that no water remains entrapped near the connectors, cracks, or crevices.
2. **Cleaning Internal Circuit Boards and Components**
   Isopropyl alcohol may be applied with a stiff, non-metallic, short-bristled brush to dislodge embedded or caked materials located in hard-to-reach areas. The brush stroke should direct the dislodged material out and away from the inside of the radio. Make sure that controls or tunable components are not soaked with alcohol. Do not use high-pressure air to hasten the drying process since this could cause the liquid to collect in unwanted places. Upon completion of the cleaning process, use a soft, absorbent, lintless cloth to dry the area. Do not brush or apply any isopropyl alcohol to the frame, front cover, or back cover.

NOTE **Always use a fresh supply of alcohol and a clean container to prevent contamination by dissolved material (from previous usage).**

3.3 Safe Handling of CMOS and LDMOS

Complementary metal-oxide semiconductor (CMOS) and lateral diffusion metal oxide semiconductor (LDMOS) devices are used in this family of radios. Their characteristics make them susceptible to damage by electrostatic or high voltage charges. Damage can be latent, resulting in failures occurring weeks or months later. Therefore, special precautions must be taken to prevent device damage during disassembly, troubleshooting, and repair.

Handling precautions are mandatory for the circuits and are especially important in low humidity conditions. DO NOT attempt to disassemble the radio without first referring to the CMOS CAUTION paragraph in the Disassembly and Reassembly section of the basic manual (See Chapter 3).

3.4 General Repair Procedures and Techniques

1. **Parts Replacement and Substitution**
   When damaged parts are replaced, identical parts should be used. If the identical replacement component is not locally available, check the parts list for the proper Motorola part number and order the component from the nearest Motorola Communications parts center listed in the “Piece Parts” section of this manual (See Chapter 1).
2. **Rigid Circuit Boards**
   The family of radios uses bonded, multi-layer, printed circuit boards. Since the inner layers are not accessible, some special considerations are required when soldering and unsoldering components. The printed-through holes may interconnect multiple layers of the printed circuit. Therefore, care should be exercised to avoid pulling the plated circuit out of the hole.
3. **When soldering near the 20-pin and 40-pin connectors:**
   - avoid accidentally getting solder in the connector.
   - be careful not to form solder bridges between the connector pins
   - closely examine your work for shorts due to solder bridges.
4. **Flexible Circuits**
   The flexible circuits are made from a different material than the rigid boards and different techniques must be used when soldering. Excessive prolonged heat on the flexible circuit can damage the material. Avoid excessive heat and excessive bending.
5. For parts replacement, use the ST-1087 Temperature-Controlled Solder Station with a 600-700 degree tip, and use small diameter solder such as ST-633. The smaller size solder will melt faster and require less heat to be applied to the circuit.

To replace a component on a flexible circuit:

- grasp the edge of the flexible circuit with seizers (hemostats) near the part to be removed
- pull gently
- apply the tip of the soldering iron to the component connections while pulling with the seizers.
- Do not attempt to puddle out components. Prolonged application of heat may damage the flexible circuit.

6. **Chip Components**
   Use either the RLN-4062 Hot-Air Repair Station or the Motorola 0180381B45 Repair Station for chip component replacement. When using the 0180381B45 Repair Station, select the TJ-65 mini-thermojet hand piece. On either unit, adjust the temperature control to 700 degrees F. (370 degrees C), and adjust the airflow to a minimum setting. Airflow can vary due to component density.
   - **To remove a chip component:**
     •Use a hot-air hand piece and position the nozzle of the hand piece approximately 1/8” (0.3 cm) above the component to be removed.

- Begin applying the hot air. Once the solder reflows, remove the component using a pair of tweezers.
- Using a solder wick and a soldering iron or a power desoldering station, remove the excess solder from the pads.

- **To replace a chip component using a soldering iron:**
  - Select the appropriate micro-tipped soldering iron and apply fresh solder to one of the solder pads.
  - Using a pair of tweezers, position the new chip component in place while heating the fresh solder.
  - Once solder wicks onto the new component, remove the heat from the solder.
  - Heat the remaining pad with the soldering iron and apply solder until it wicks to the component. If necessary, touch up the first side. All solder joints should be smooth and shiny.
- **To replace a chip component using hot air:**
  - Use the hot-air hand piece and reflow the solder on the solder pads to smooth it.
  - Apply a drop of solder paste flux to each pad.
  - Using a pair of tweezers, position the new component in place.
  - Position the hot-air hand piece approximately 1/8” (0.3 cm) above the component and begin applying heat.
  - Once the solder wicks to the component, remove the heat and inspect the repair. All joints should be smooth and shiny.

3.5 Shields

Removing and replacing shields will be done with the R-1070 station with the temperature control set to approximately 415°F (215°C) [445°F (230°C) maximum]

- **To remove the shield:**
  - Place the circuit board in the R-1070’s holder.
  - Select the proper heat focus head and attach it to the heater chimney.
  - Add solder paste flux around the base of the shield.
  - Position the shield under the heat-focus head.
  - Lower the vacuum tip and attach it to the shield by turning on the vacuum pump.
  - Lower the focus head until it is approximately 1/8” (0.3 cm) above the shield.
  - Turn on the heater and wait until the shield lifts off the circuit board.
  - Once the shield is off, turn off the heat, grab the part with a pair of tweezers, and turn off the vacuum pump.
  - Remove the circuit board from the R-1070’s circuit board holder.
- **To replace the shield:**
  - Add solder to the shield if necessary, using a micro-tipped soldering iron.
  - Next, rub the soldering iron tip along the edge of the shield to smooth out any excess solder. Use solder wick and a soldering iron to remove excess solder from the solder pads on the circuit board.
  - Place the circuit board back in the R1070’s circuit board holder.
  - Place the shield on the circuit board using a pair of tweezers.
  - Position the heat-focus head over the shield and lower it to approximately 1/8” (0.3 cm) above the shield.
  - Turn on the heater and wait for the solder to reflow.
  - Once complete, turn off the heat, raise the heat-focus head and wait approximately one minute for the part to cool.
  - Remove the circuit board and inspect the repair. No cleaning should be necessary.

3.6 Recommended Test Tools

Table 3-1 lists the tools recommended for working on this family of radios. These tools are also available from Motorola.

Table 3-1. **Recommended Test Tools**

MotorolaPart Number	Description:	Application:
RSX4043A	Torx Driver	Tighten and remove chassis screws
6680387A70	T-6 Torx Bit	Removable Torx driver bit
R1453A	Digital readout solder station	Digitally controlled soldering iron
RLN4062A	Hot Air Workstation, 120V	Tool for hot air soldering / desoldering of surface mounted integrated circuits.
0180386A78	Illuminated magnifying glass with lens attachment.	
0180302E51	Master Lens System	Illumination and magnification of components
0180386A82	Anti-static grounding kit	Used during all radio assembly and disassembly procedures
6684253C72	Straight prober	
6680384A98	Brush	
1010041A86	Solder (RMA type), 63/37,	0.5mm diameter, 1 lb. spool
0180303E45	SMD tool kit	(included with R1319A)
R1319A (110V) ChipMaster	Surface Mount Removal and assembly of	
R1321A (220V)	surface-mounted integrated circuits and or Rework Station shields. Includes 5 nozzles	
ChipMaster Options		Heat-focus heads for R-1319A work station
6680370B54 0.710" x 0.710"		
6680370B57 0.245" x 0.245"		
6680370B58 0.340" x 0.340"		
6680371B15 0.460" x 0.560"		
ChipMaster Nozzles		ChipMaster Nozzles
6680333E28		PA Nozzle
6680332E83		PLCC-28* Nozzle
6680332E93		PLCC-32 Nozzle
6680332E82		PLCC-44* Nozzle
6680332E94		PLCC-52 Nozzle
6680332E95		PLCC-68* Nozzle
6680332E96		PLCC-84 Nozzle
6680332E89		QFP-80 Nozzle

Table 3-1. **Recommended Test Tools**

MotorolaPart Number	Description:	Application:
6680332E90		QFP-100* Nozzle
6680332E91		QFP-132* Nozzle
ChipMaster Nozzles		ChipMaster Nozzles
6680334E67		QFP-160 Nozzle
6680332E86		SOIC-14/SOL-16J Nozzle
6680333E46		SOL-18 Nozzle
6680332E84		SOIC-20 Nozzle
6680332E87		SOL-20J Nozzle
6680332E88		SOL-28J Nozzle
6680333E55		TSOP-64 Nozzle
R1364A	Digital Heated Tweezer System Chip component removal	
R1427A	Board Preheater	Reduces heatsink on multi level boards
6680309B53	Rework Equipment Catalog	Contains application notes, procedures and Technical references: Rework Equipment

* Included with Chipmaster packages.

Table 3-2. Recommended Test Equipment

MotorolaPart Number	Description:	Application:
R2600 Series	System Analyzer	Frequency/deviation meter and signal items with an asterisk (*).generator for wide range trouble shooting and alignment.
*R1074A	Fluke 87 Digital	True RMS metering, 200KHz Digital voltmeter is recommended for AC / Multi-meter. frequency counter, 32 segmentDC voltage and current measurements. bargraph w/ backlit display.
*R1377A	AC Voltmeter	1mV to 300V, 10 Mega Ohm Audio voltage measurements input impedance.
R1611A	Dual Channel 100MHz	Two-channel, 100 MHz band- Waveform Measurements. Oscilloscope (Agillent width 200 M sample rate / sec. and 2Mb memory / channel.

Table 3-2. Recommended Test Equipment

MotorolaPart Number	Description:	Application:
S1339A	RF Milli-Voltmeter	100uV to 3V RF, 10KHz to 1GHzRF level measurements. frequency range.
*R1013B	SINAD Meter	w/o RMS Audio Voltmeter. Receiver Sensitivity Measurements. or *R1370A SINAD Meter w/ RMS w/ RMS Audio Voltmeter. Receiver Sensitivity Measurements.
S1348D	Programmable DC	0-20VDC, 0-5Amps, current Bench Supply for 7.5Vdc. Power Supply limited

3.7 Replacing the Circuit Board Fuse

In cases where the radio fails to turn on when power is applied, the circuit board fuse should always be checked as a probable cause of the failure. The locations of the fuse for both the UHF and VHF boards are shown in Figure 3-1. The radio must be disassembled to replace the fuses as described in the Basic Service Manual (see Chapter 1 - Related Documents), then the circuit board separated from the radio chassis as described in the paragraphs that follow.

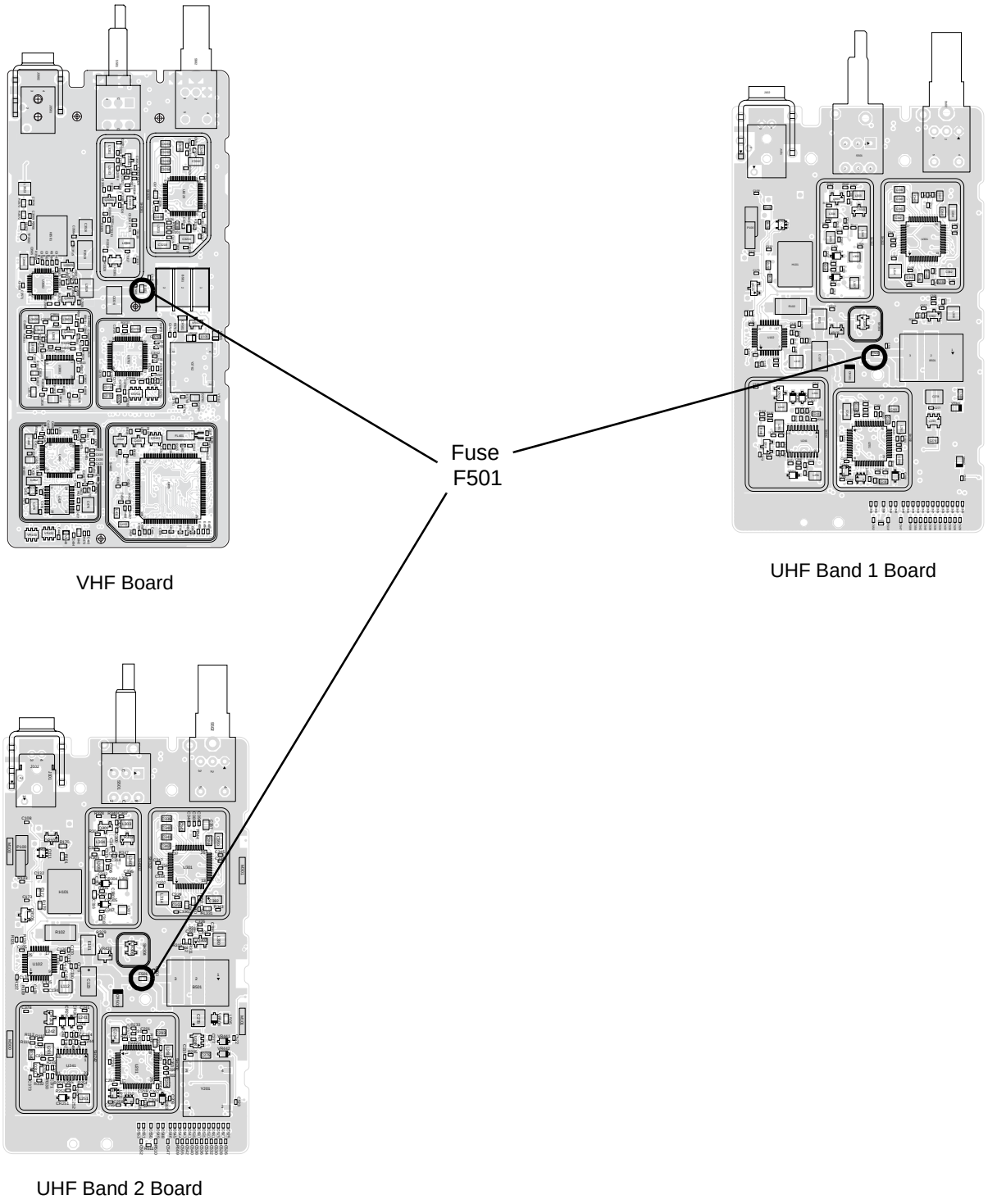


Figure 3-1. VHF, UHF Band 1, and UHF Band 2 Circuit Board Fuse Location

3.8 Removing and Reinstalling the Circuit Board

Both the UHF and VHF circuit boards are removed from the radio chassis in the following manner:

1. Refer to the Basic Service Manual (see Chapter 3- Related Documents) for radio disassembly, then use a philips screwdriver and to remove the four M2X4 screws shown in Figure 3-2.
2. Lift the circuit board out of the radio chassis, then remove and discard the O-rings located between the circuit board and chassis.
3. After repairs, replace the O-rings then reinstall the circuit board into the radio chassis.
4. Reinstall and tighten the four Torx screws to secure the circuit board to the chassis.
5. Refer to the Basic Service Manual to reassemble the radio.

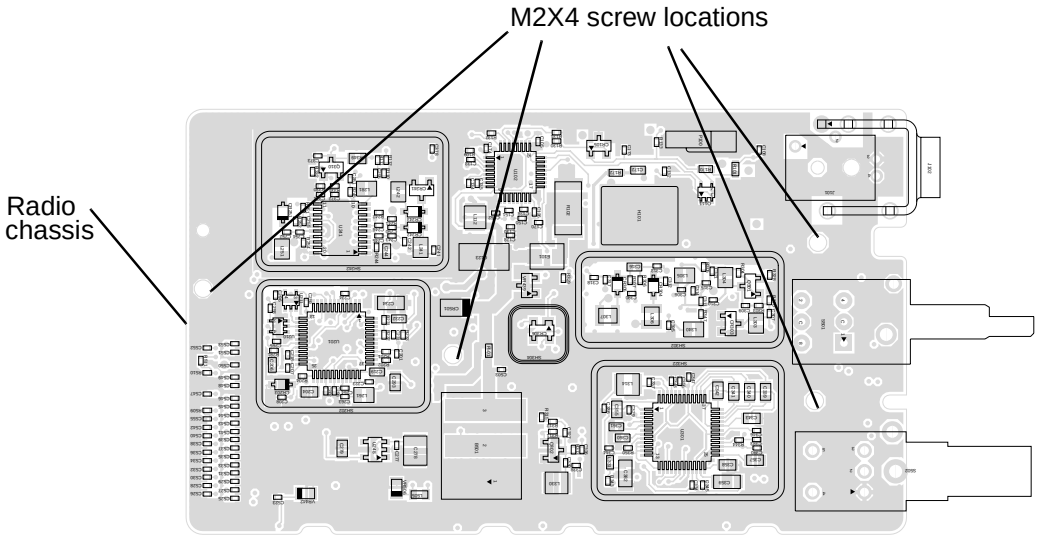


Figure 3-2. Circuit Board Removal and Reinstallation

3.9 Error Codes

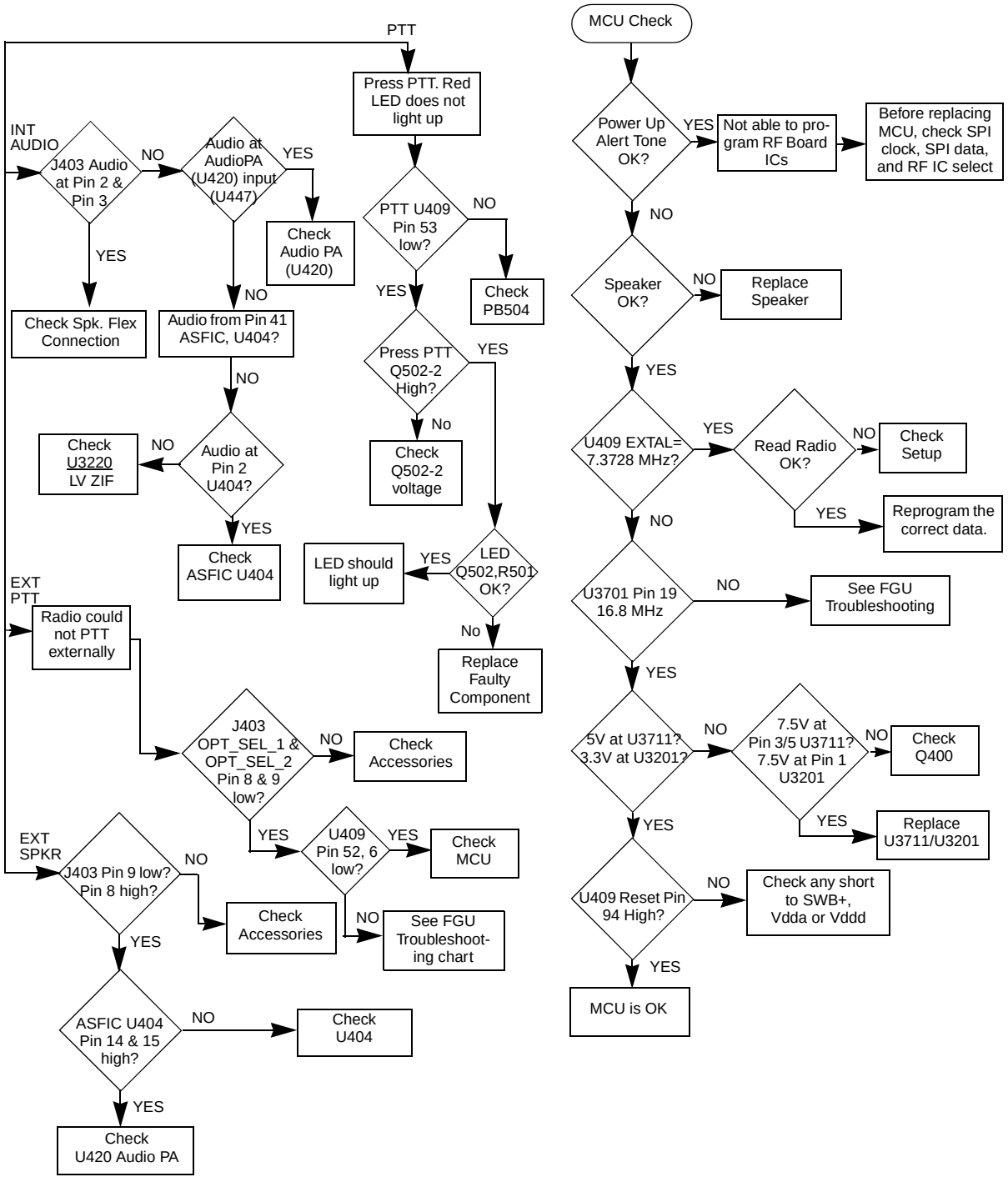
Turning on the radio using the ON/OFF volume control starts a self-test routine which checks the RAM, ROM checksum, EEPROM hardware and EEPROM checksum. If these checks are successfully completed, the radio will generate the Self-Test Pass Tone. Radio emits a low pitch tone if it fails the self-test.

*Error Code	Explanation	Corrective Action
“RAM TST ERROR”	RAM Test Failure	Retest radio by turning it off and turning it on again. If message reoccurs, replace RAM (U405).
“ROM CS ERROR”	ROM Checksum is wrong.	Reprogram FLASH Memory, then retest. If message reoccurs, replace ROM (U406).
“EEPRM HW ERROR”	Codeplug structure mismatch, non existence of codeplug.	Reprogram codeplug with correct version and retest radio. If message reoccurs, replace EEPROM (U407).

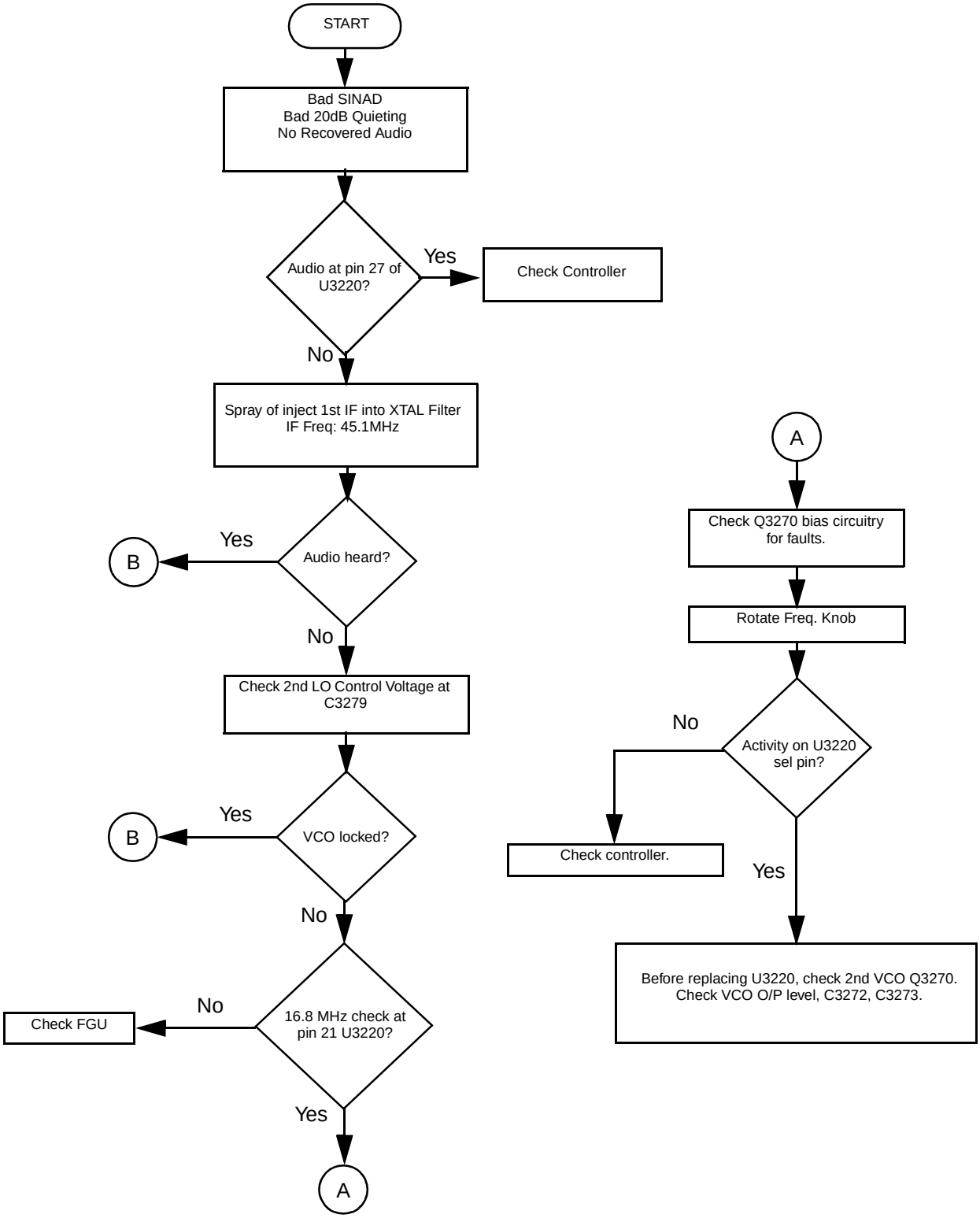
*Error Code	Explanation	Corrective Action
“EEPRM CS ERROR”	Codeplug check-sum is wrong.	Reprogram codeplug.
No Display	Display module is not connected properly. Display module is damaged.	Check connection between main board and display module. Replace with new display module.

NOTE: *Error Codes are displayed on display radios only.

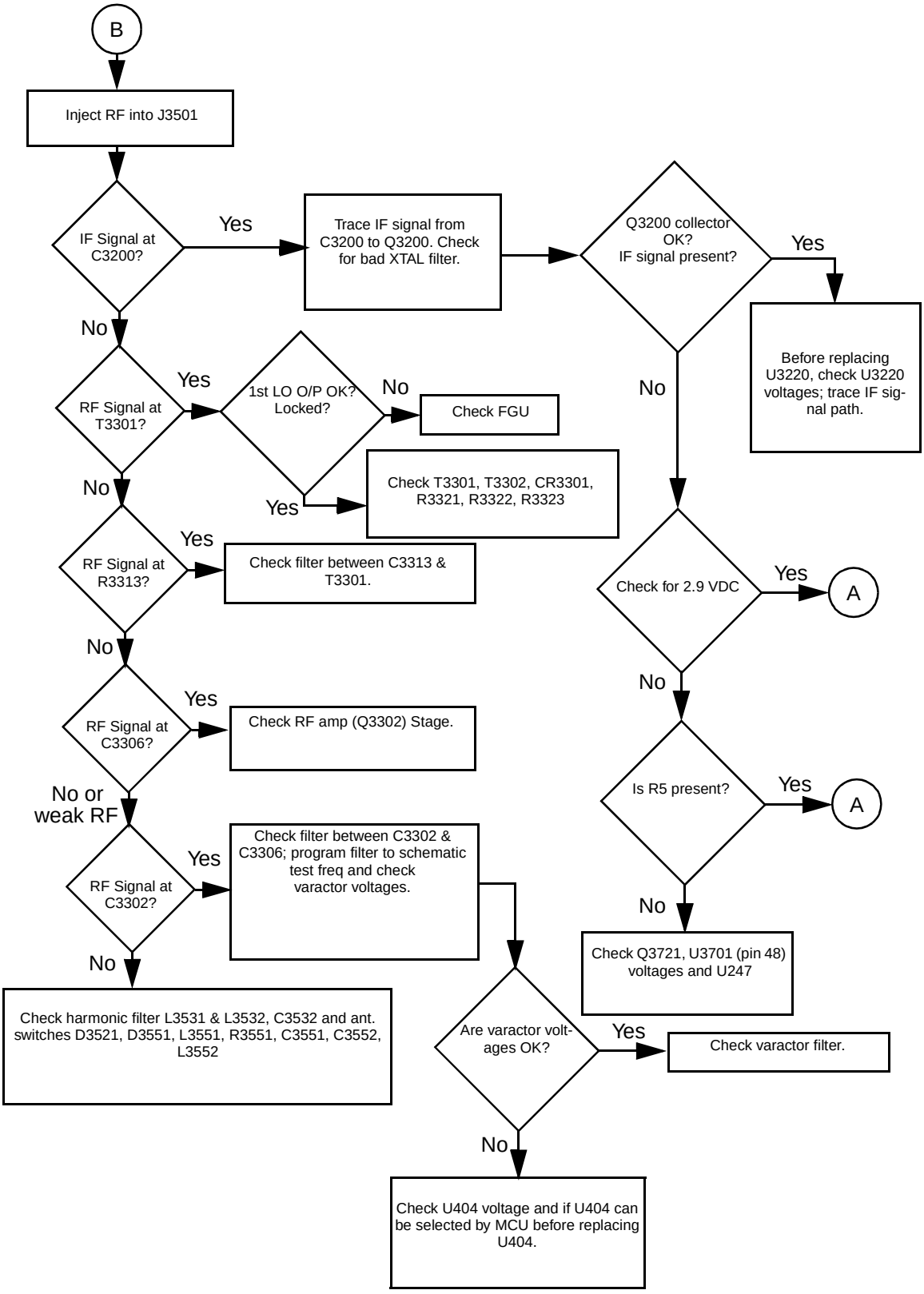
3.10 VHF Troubleshooting Charts



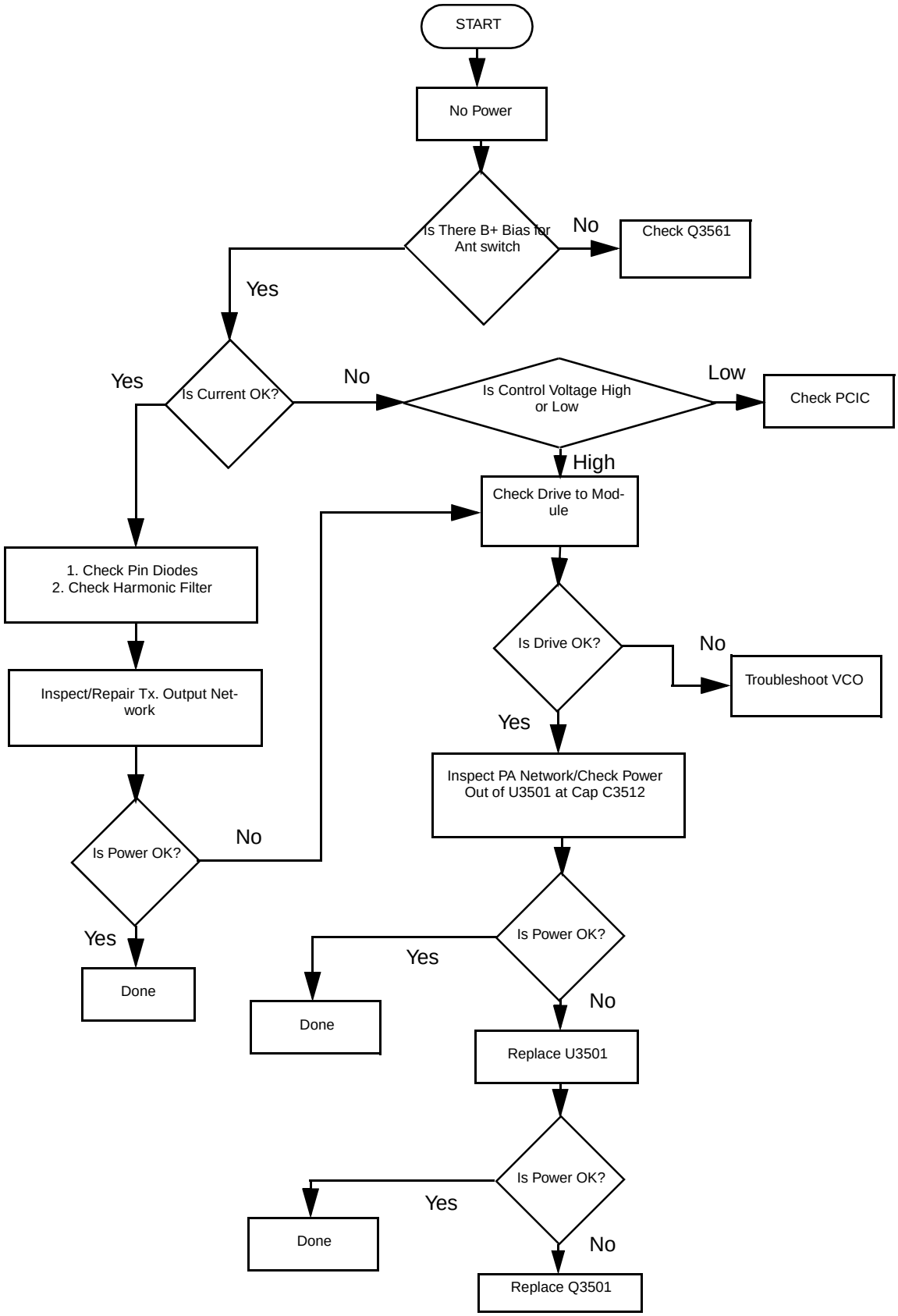
Troubleshooting Flow Chart for Controller



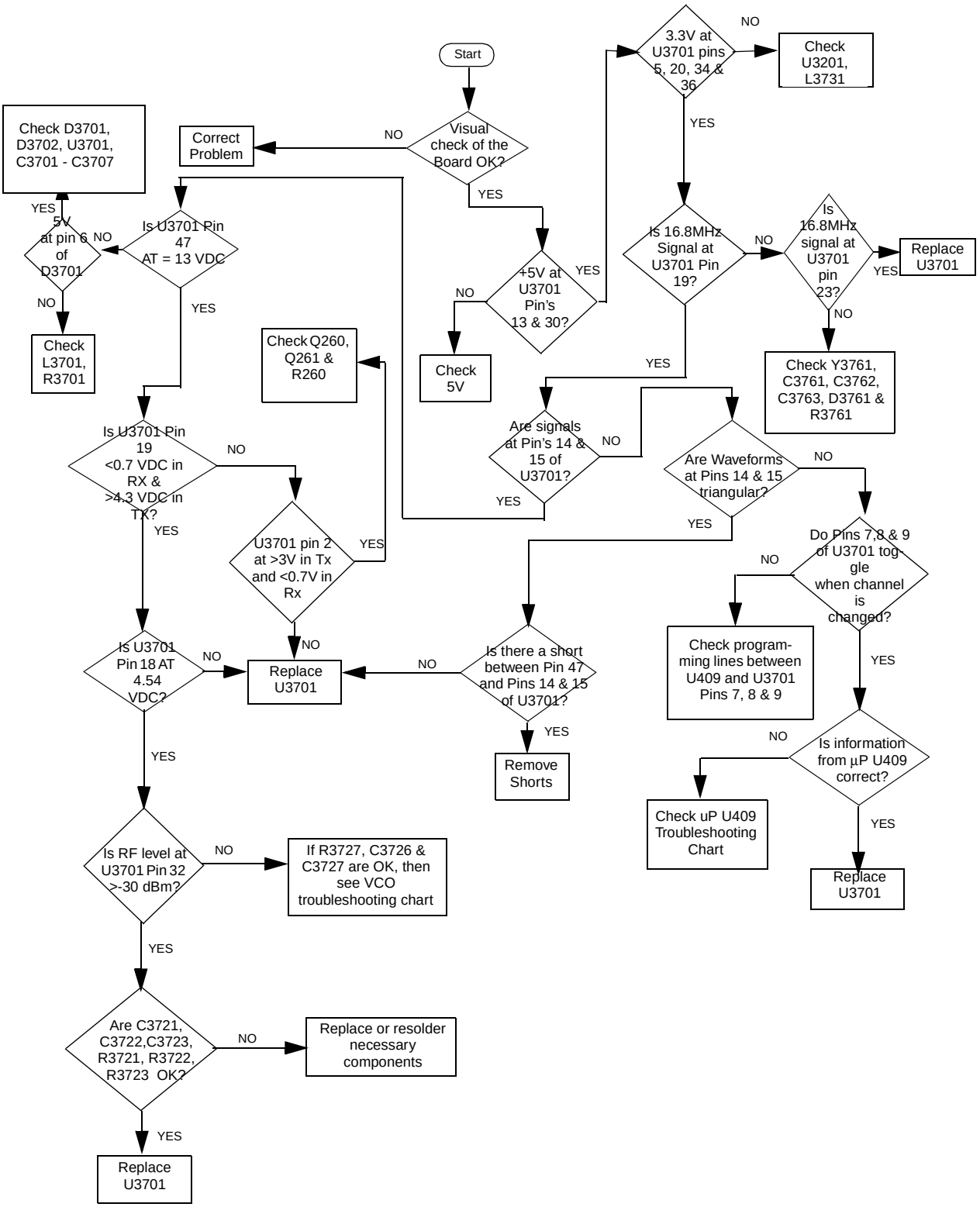
Troubleshooting Flow Chart for Receiver (Sheet 1 of 2)



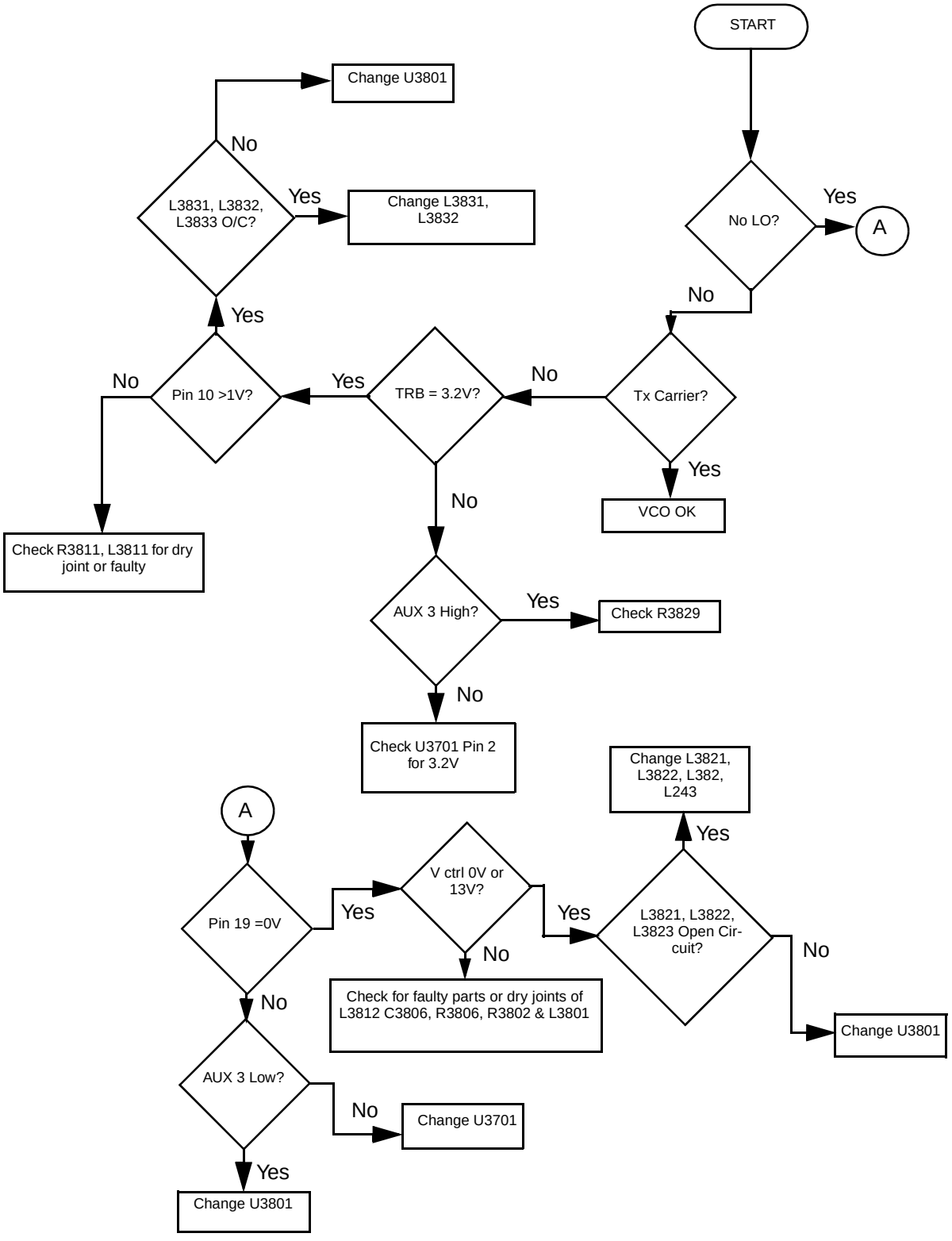
Troubleshooting Flow Chart for Receiver (Sheet 2 of 2)



Troubleshooting Flow Chart for Transmitter

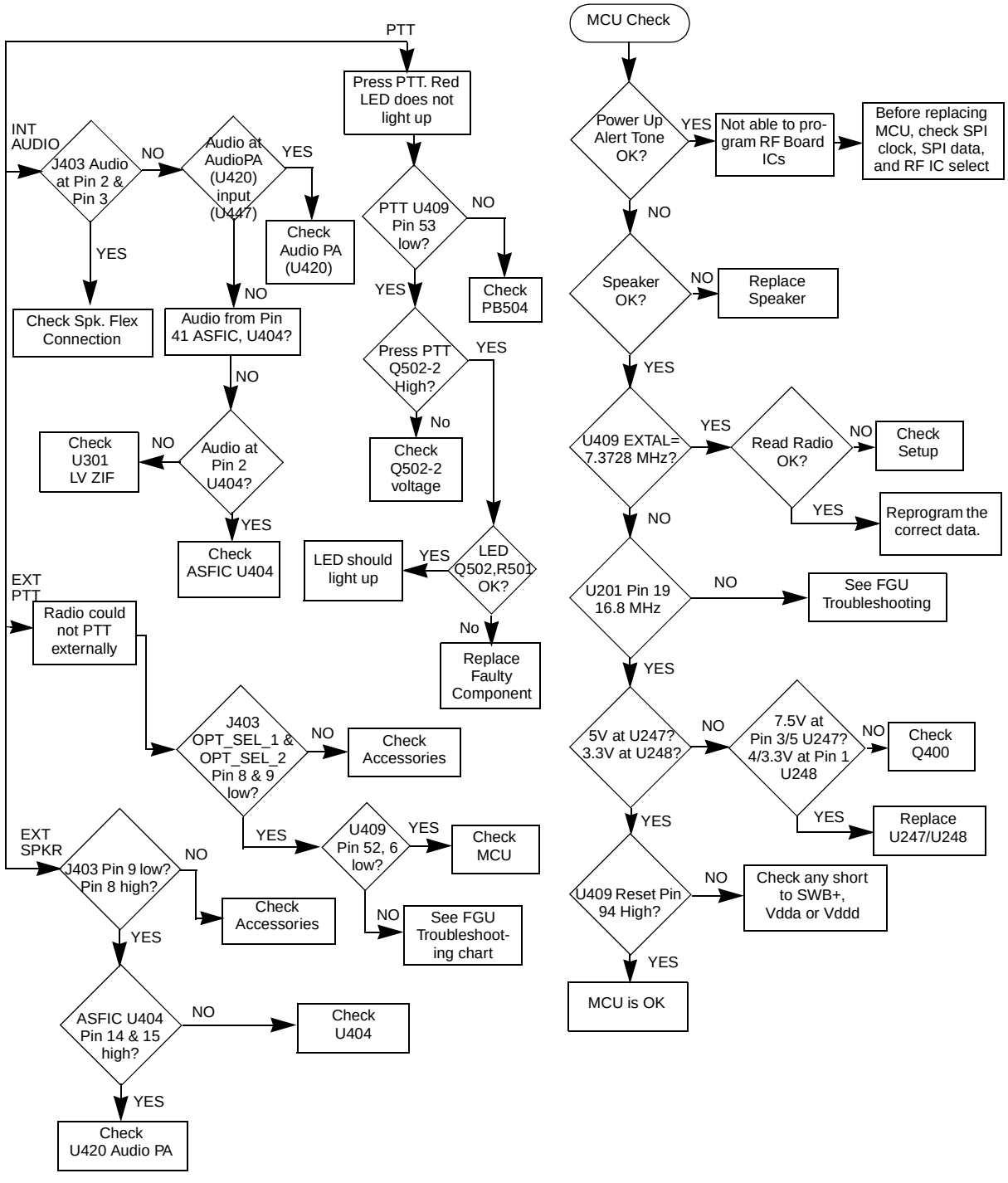


Troubleshooting Flow Chart for Synthesizer

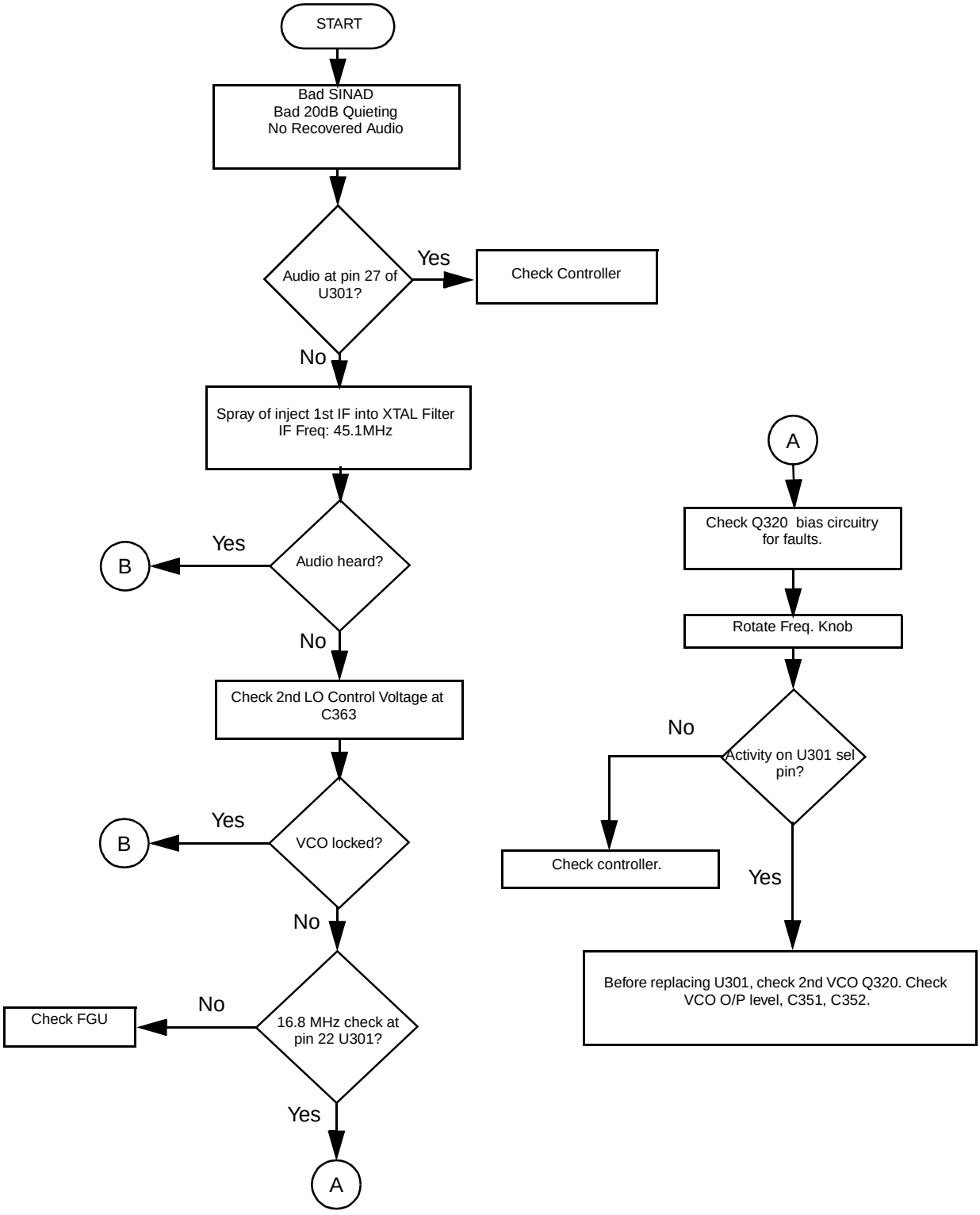


Troubleshooting Flow Chart for VCO

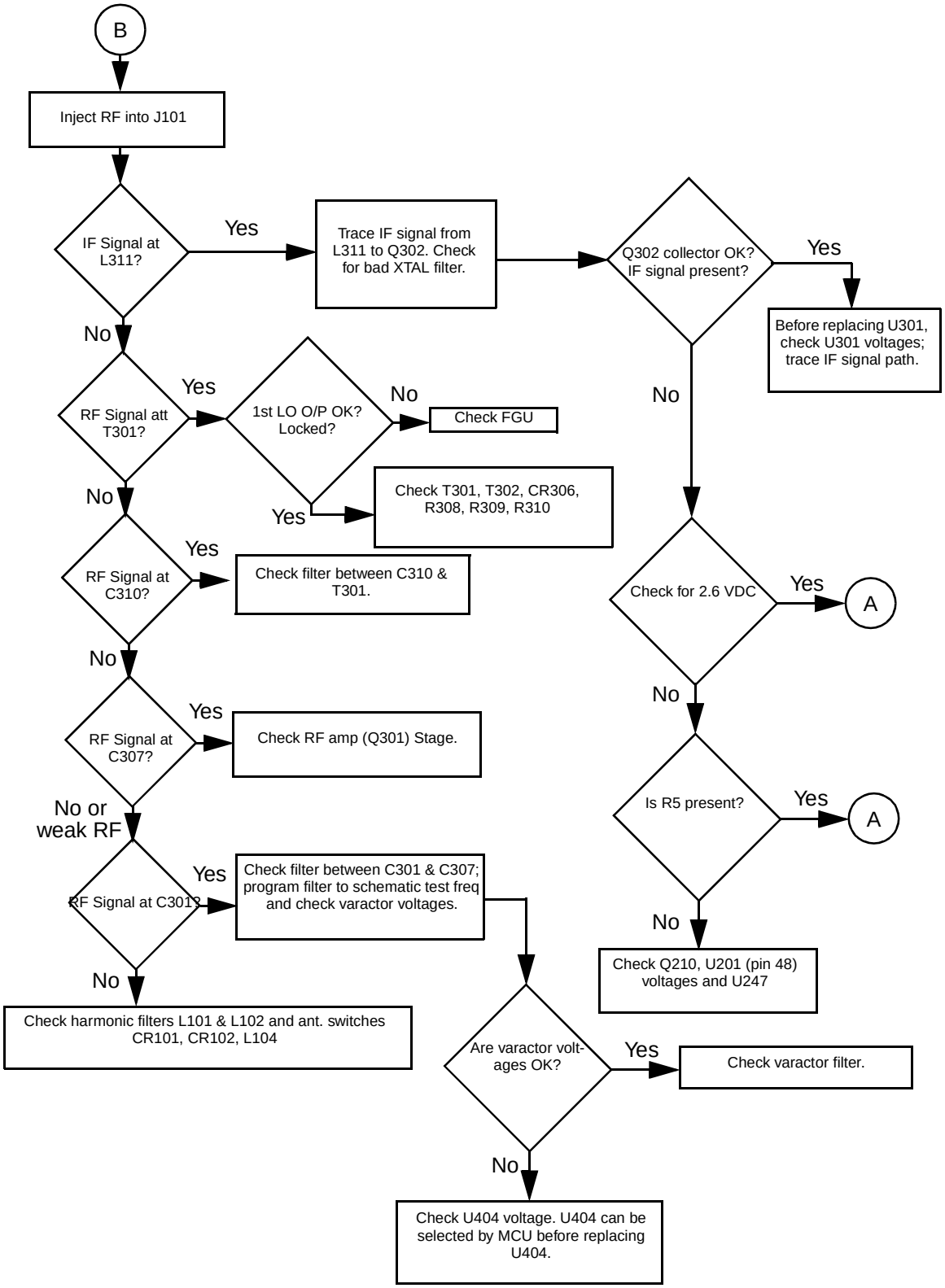
3.11 UHF (Band 1 and Band 2) Troubleshooting Charts



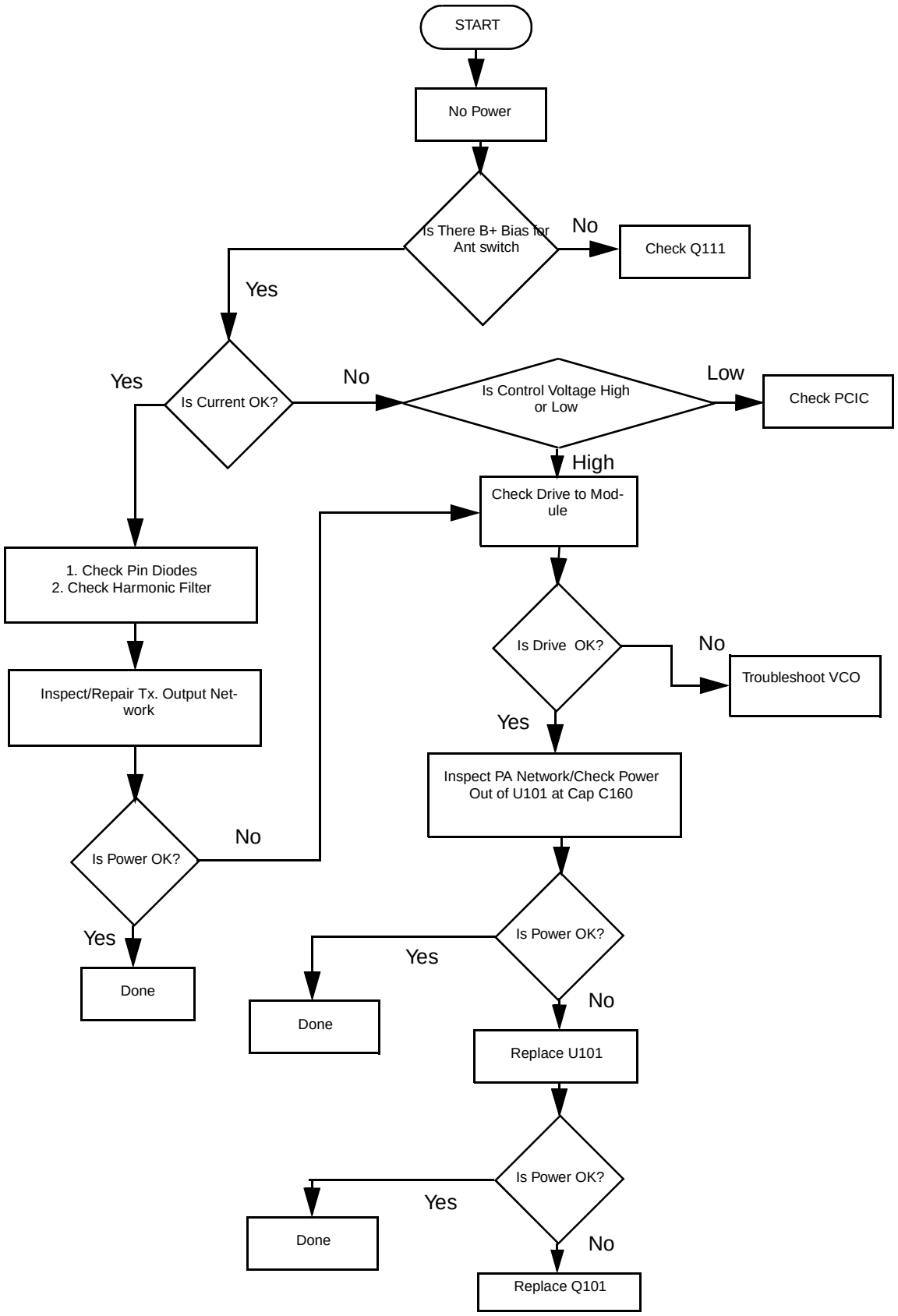
Troubleshooting Flow Chart for Controller



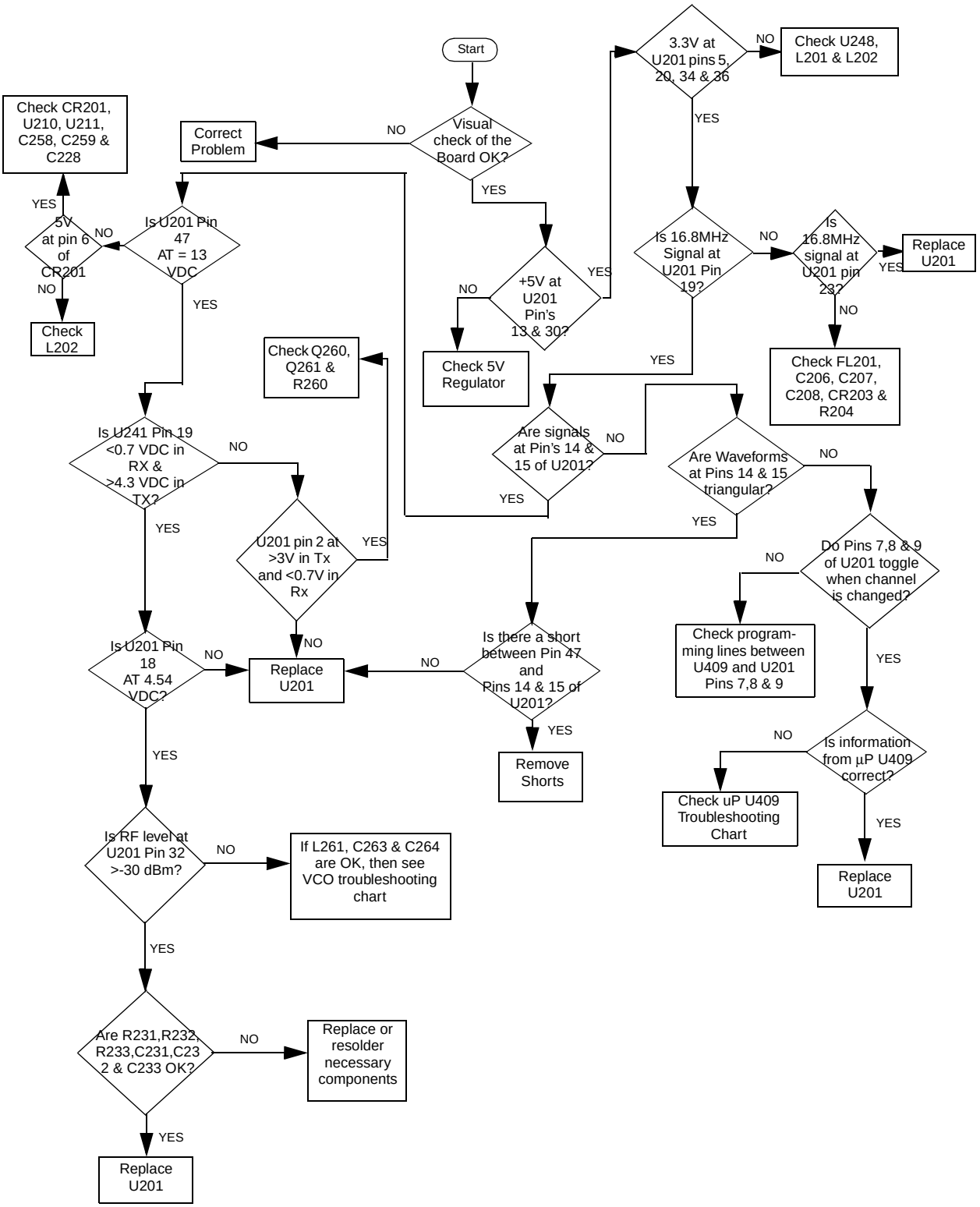
Troubleshooting Flow Chart for Receiver (Sheet 1 of 2)



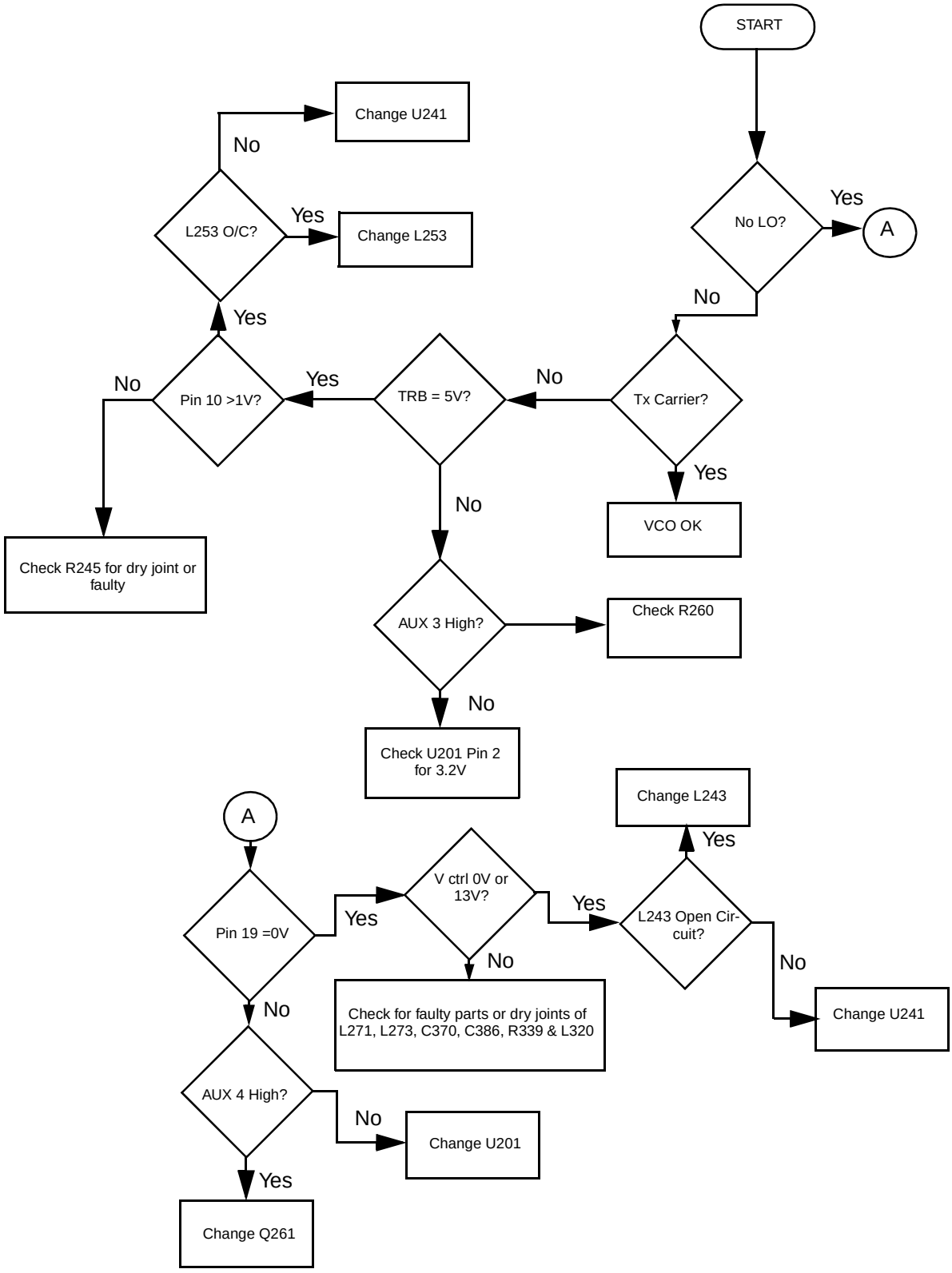
Troubleshooting Flow Chart for Receiver (Sheet 2 of 2)



Troubleshooting Flow Chart for Transmitter

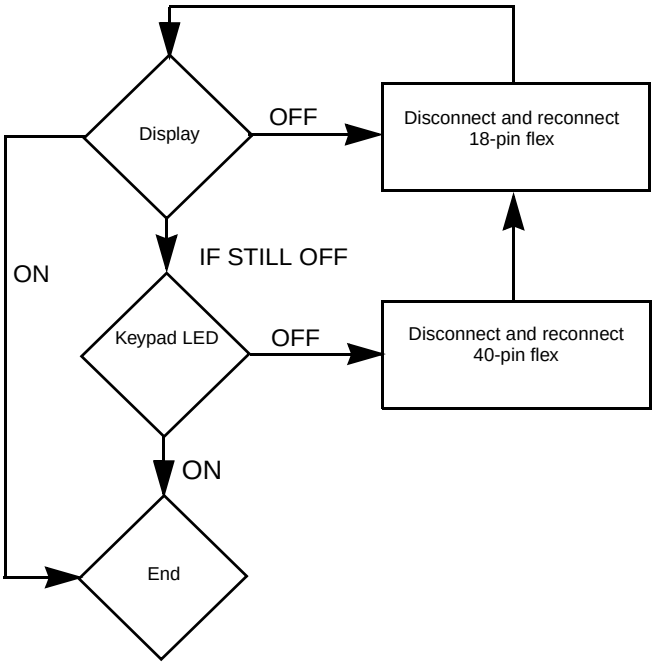


Troubleshooting Flow Chart for Synthesizer



Troubleshooting Flow Chart for VCO

3.12 Keypad Troubleshooting Chart



Chapter 4 Schematic Diagrams, Overlays, and Part Lists

4.1 Introduction

This chapter provides schematic diagrams, overlays, and parts lists for the radio circuit board and interface connections.

4.1.1 Notes For All Schematics and Circuit Boards

* Component is frequency sensitive. Refer to the Electrical Parts List for value and usage.

1. Unless otherwise stated, resistances are in Ohms (k = 1000), and capacitances are in picofarads (pF) or microfarads (µF).
2. DC voltages are measured from point indicated to chassis ground using a Motorola DC multimeter or equivalent. Transmitter measurements should be made with a 1.2 µH choke in series with the voltage probe to prevent circuit loading.
3. Reference Designators are assigned in the following manner:

100 Series	=	Transmitter UHF
200 Series	=	Frequency Generation UHF
300 Series	=	Receiver UHF
400/500 Series	=	Controller
600 Series	=	Keypad Board
3200 Series	=	IF Circuitry
3300 Series	=	Receiver VHF
3500 Series	=	Transmitter VHF
3700/3800 Series	=	Frequency Generation VHF

4. Interconnect Tie Point Legend:

UNSWB+	=	Unswitch Battery Voltage (7.5V)
SWB+	=	Switch Battery Voltage (7.5V)
R5	=	Receiver Five Volts
CLK	=	Clock
Vdda	=	Regulated 3.3 Volts (for analog)
Vddd	=	Regulated 3.3 Volts (for digital)
CSX	=	Chip Select Line (not for LVZIF)
SYN	=	Synthesizer
DACRX	=	Digital to Analog Voltage (For Receiver Front End Filter)
VSF	=	Voltage Super Filtered (5 volts)
VR	=	Voltage Regulator

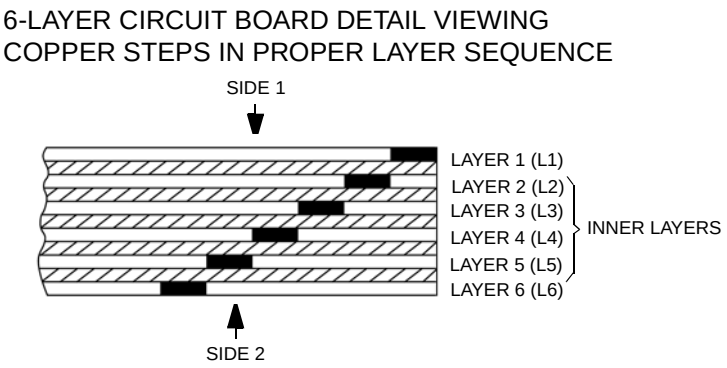


Figure 4-1. Circuit Board Layering Sequence

4.2 RF - Controller Interconnect Flex

4.2.1 Plain

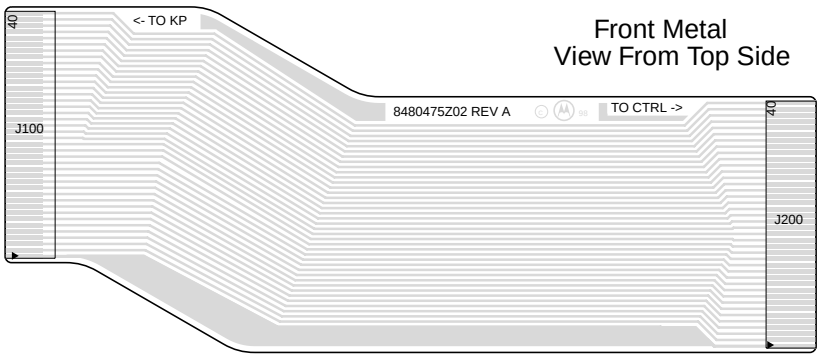


Figure 4-2. Plain Controller Interconnect Flex

4.2.2 Keypad

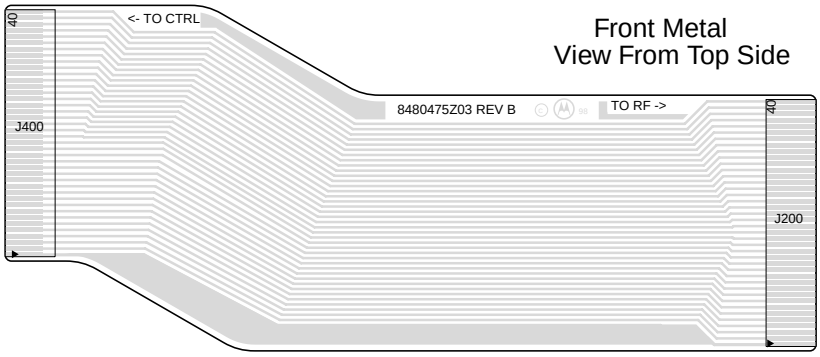


Figure 4-3. Keypad Controller Interconnect Flex

4.2.3 Schematic for RF - Controller Interconnect Flex

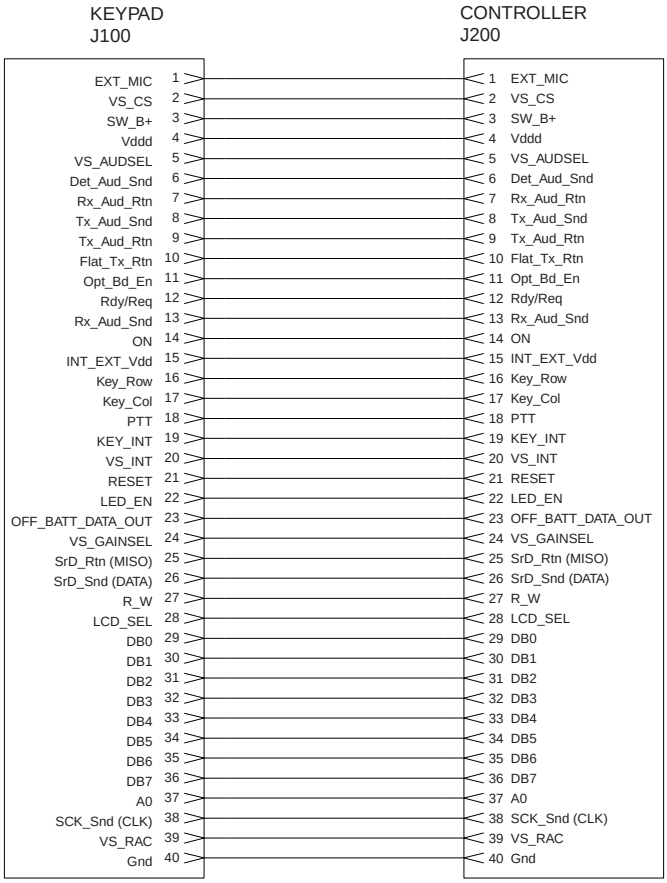
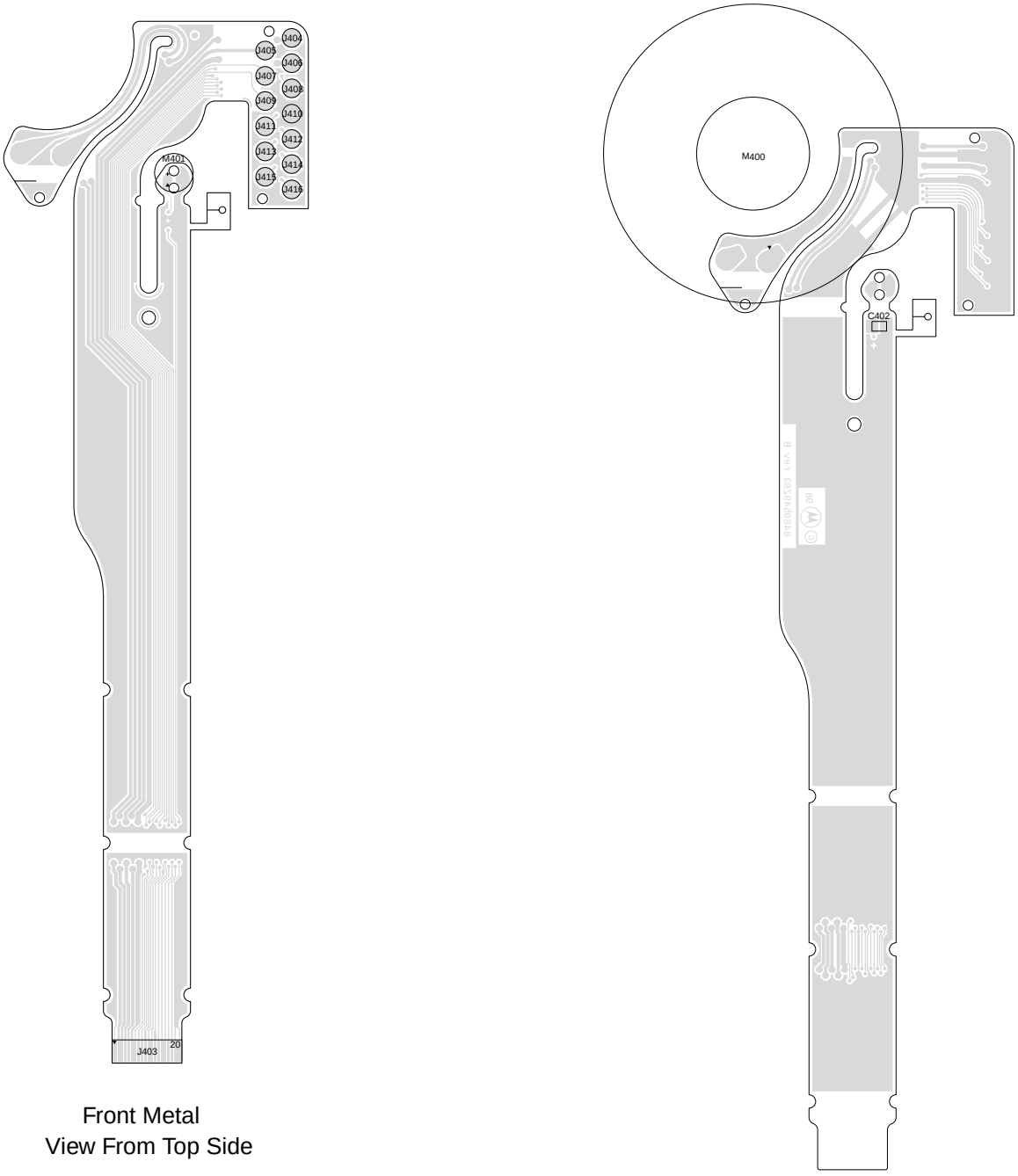


Figure 4-4. Keypad-Controller Interconnect Schematic Diagram

4.2.4 Parts List for Keypad-Controller Interconnect Flex

Reference Symbol	Motorola Part No.	Description
J100	0980521Z01	Connector, 40 pin
J200	0905505Y04	Speaker, 20 ohm

4.2.5 Universal Connector Flex Plain



Front Metal
View From Top Side

Figure 4-5. Universal Flex Connector Plain

4.2.6 Universal Connector Flex Keypad

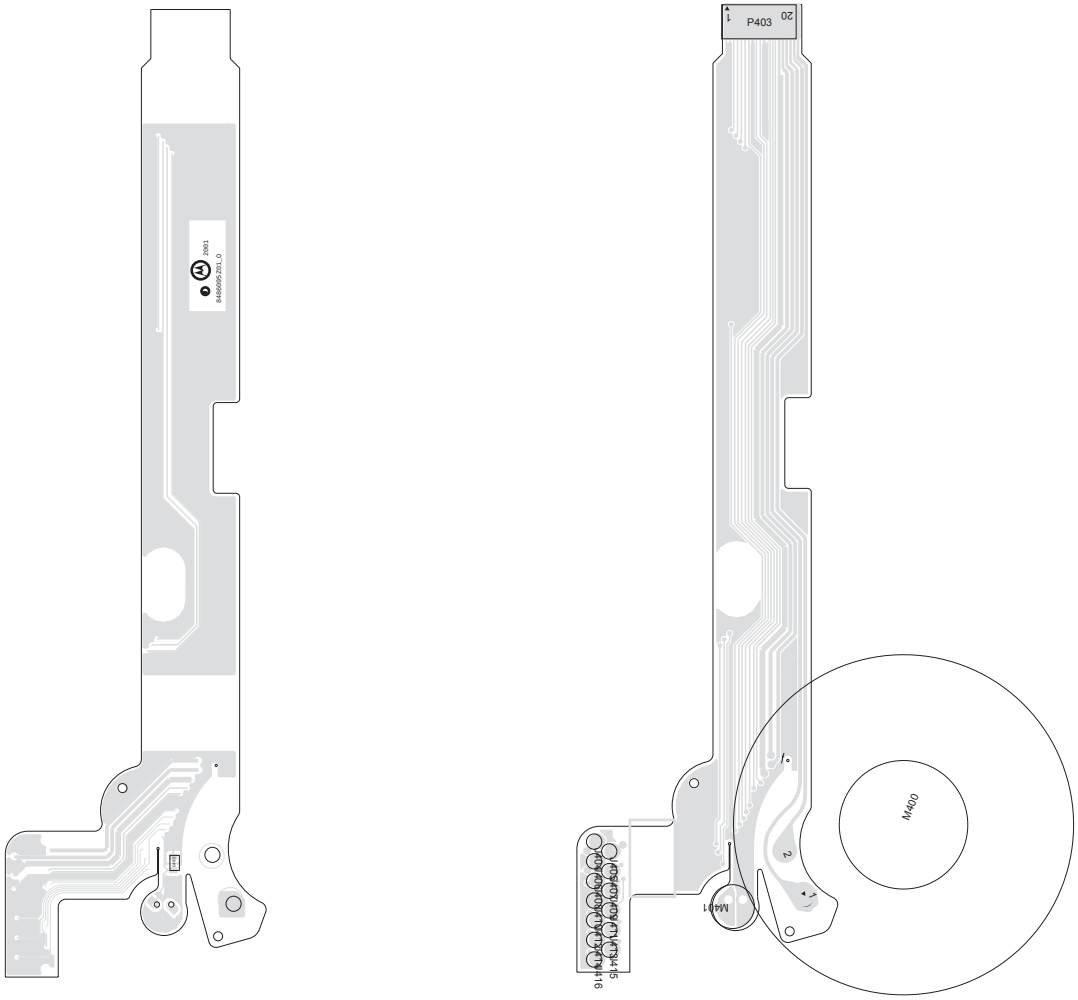


Figure 4-6. Universal Flex Connector Keypad

4.2.7 Schematic for Universal Connector Flex Plain

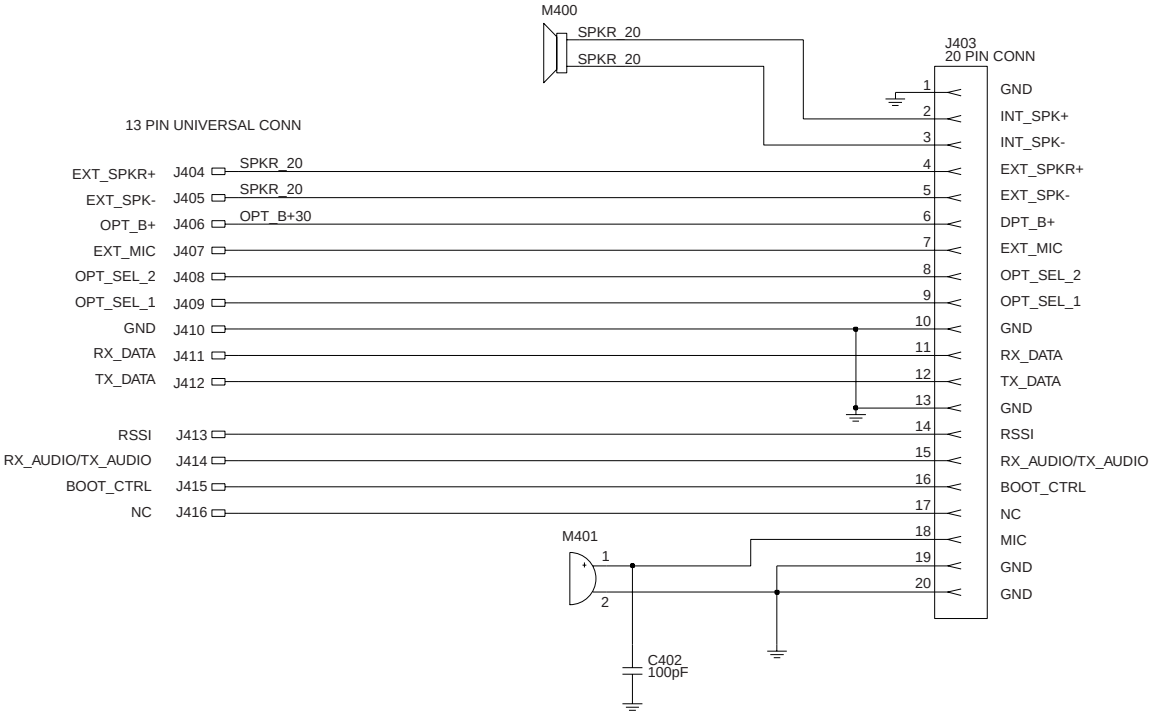


Figure 4-7. Universal Connector Schematic Diagram

4.2.8 Parts List for Universal Connector Flex Plain

Reference Symbol	Motorola Part No.	Description
C402	2113740A55	Cap, 100pF
M400	5005679X01	Speaker, 24 ohm
M401	5013920A04	Mic, Mini electrec

4.2.9 Schematic for Universal Connector Flex Keypad

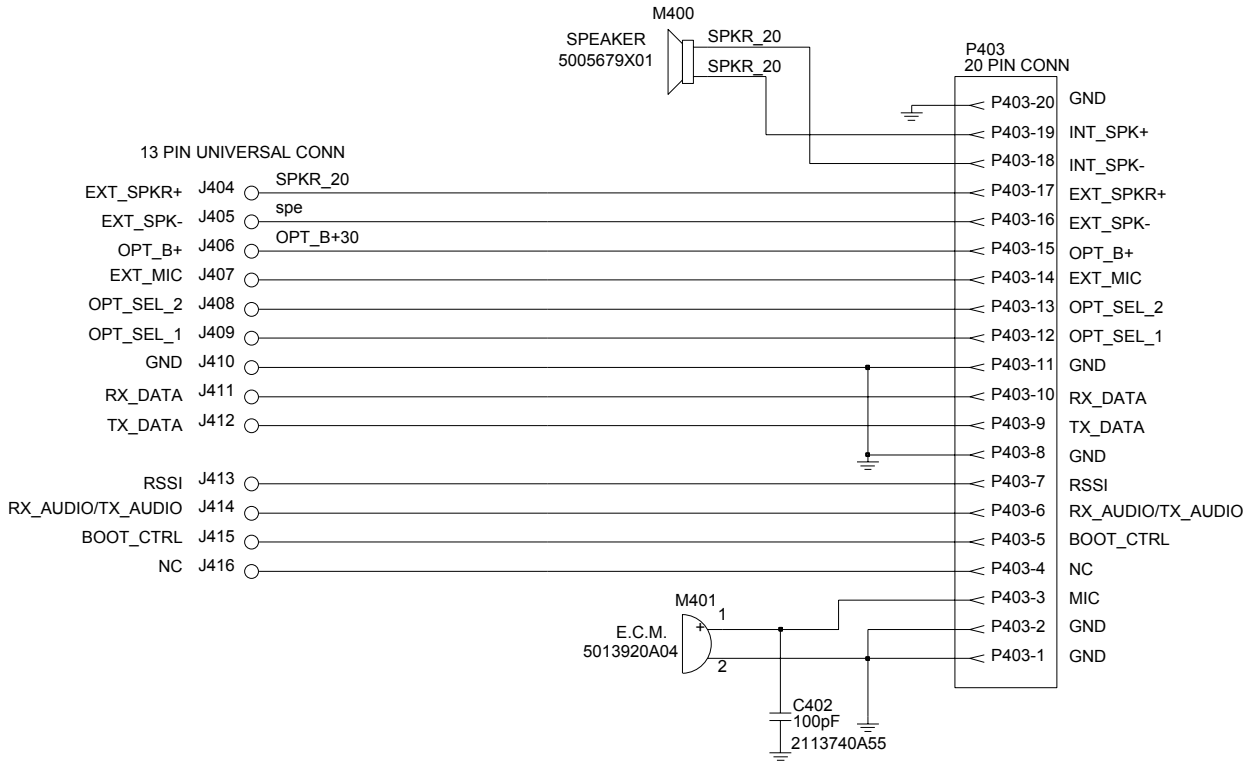


Figure 4-8. Universal Connector Schematic Diagram Keypad

4.2.10 Parts List for Universal Connector Flex Keypad

Reference Symbol	Motorola Part No.	Description
C402	2113740A55	Cap, 100pF
M400	5086094Z01	Speaker, 20 ohm
M401	5013920A04	Mic, Mini electrec

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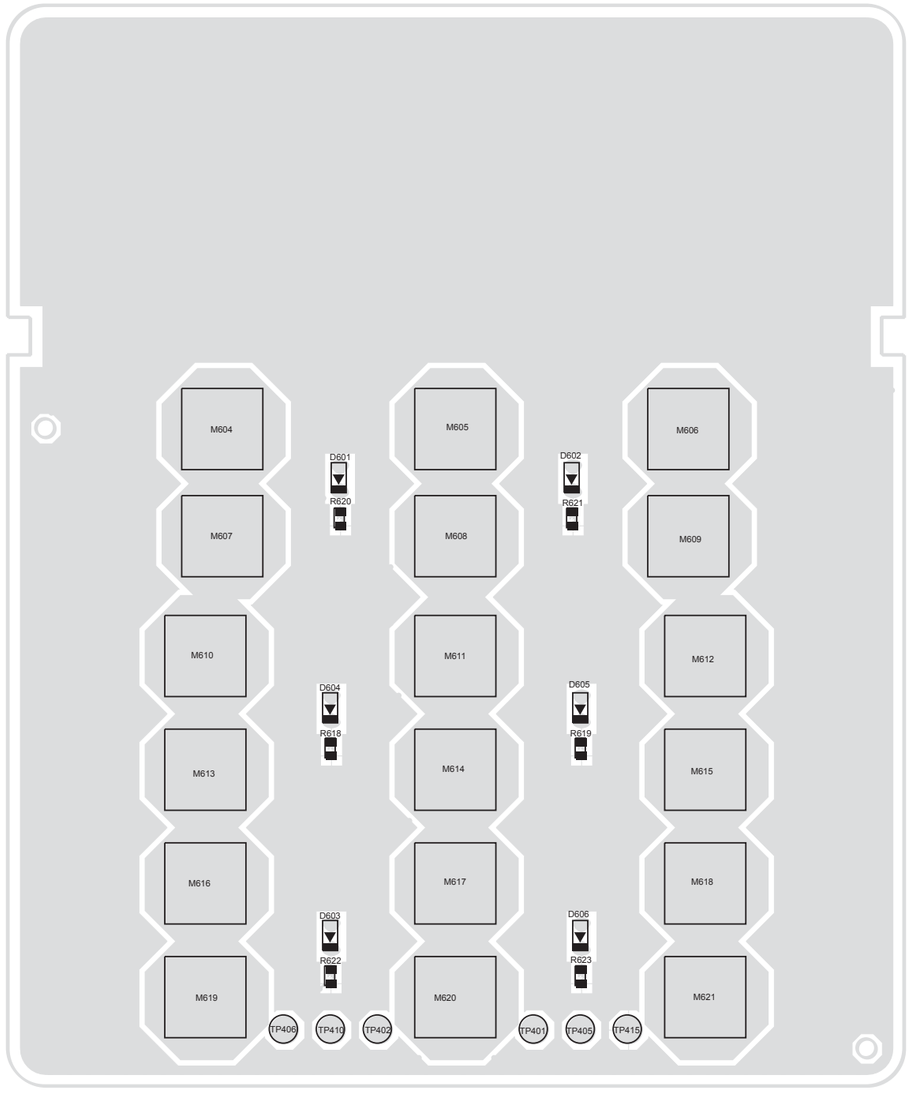
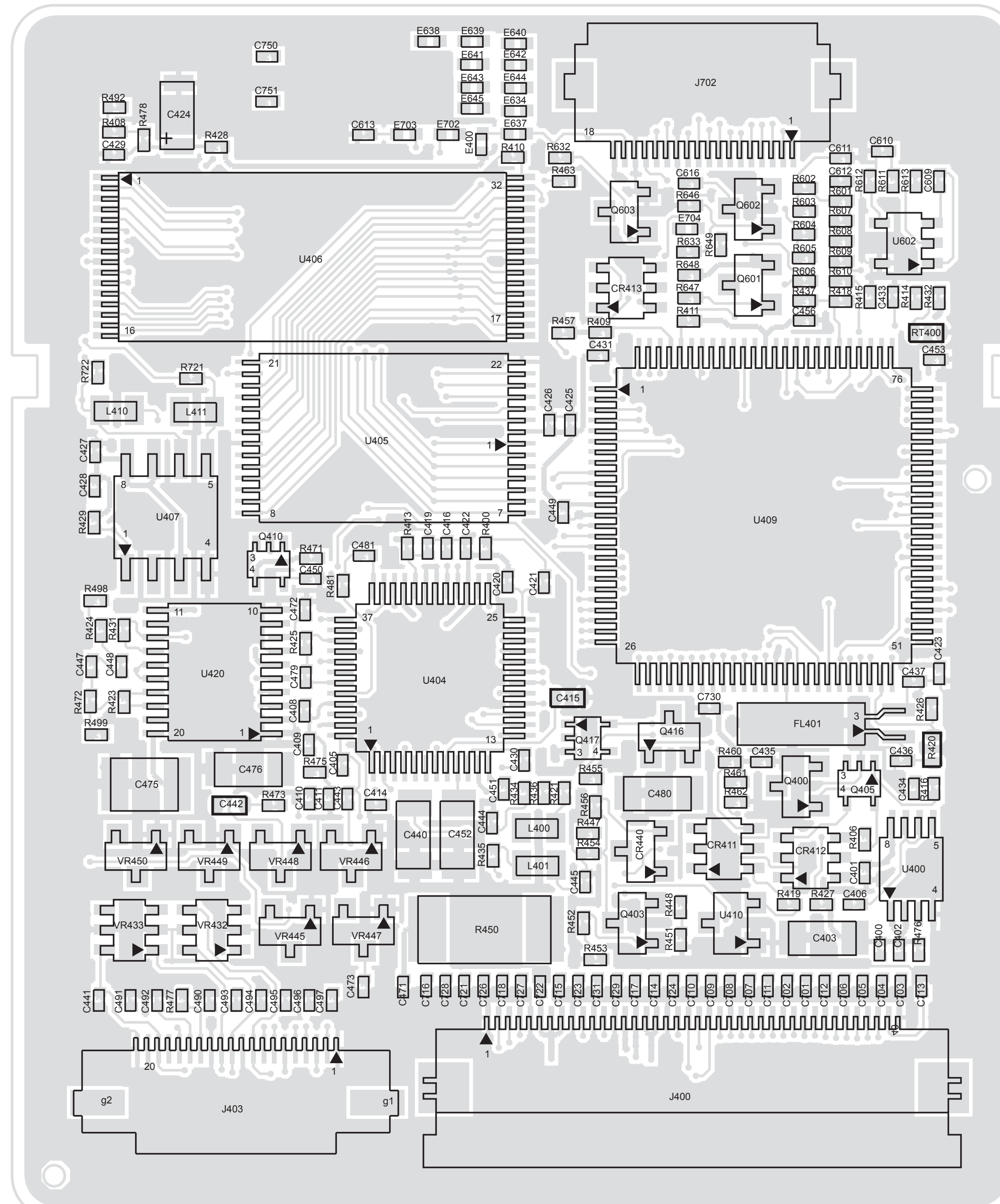
5.1 Controller Board Diagrams



ZMY0130800-O

Figure 5-1: Controller Board Top View for VHF & UHF1 (PCB No. 8404051G01



ZMY0130801-O

Figure 5-2: Controller Board Bottom View for VHF & UHF1 (PCB No.8404051G01)

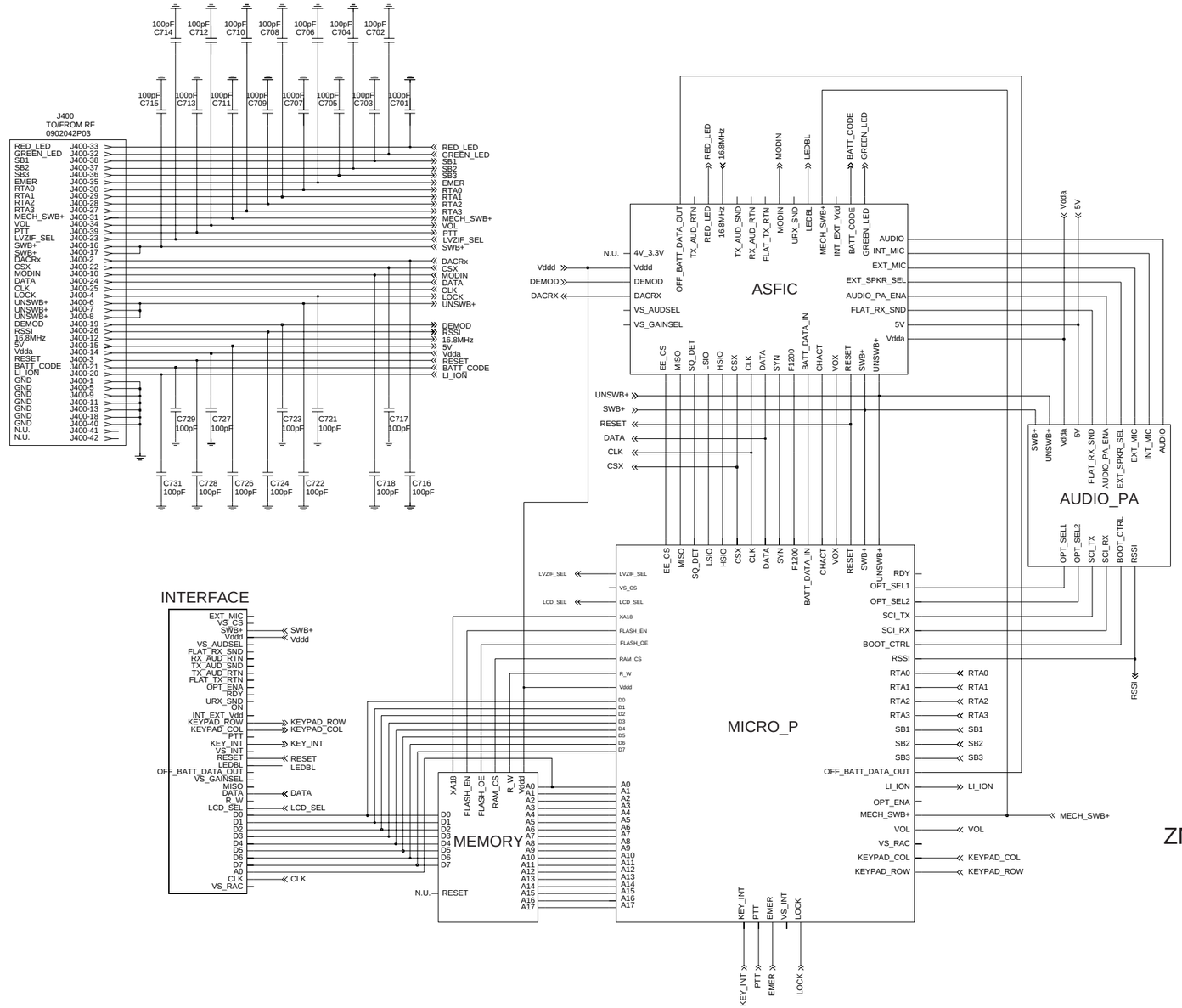
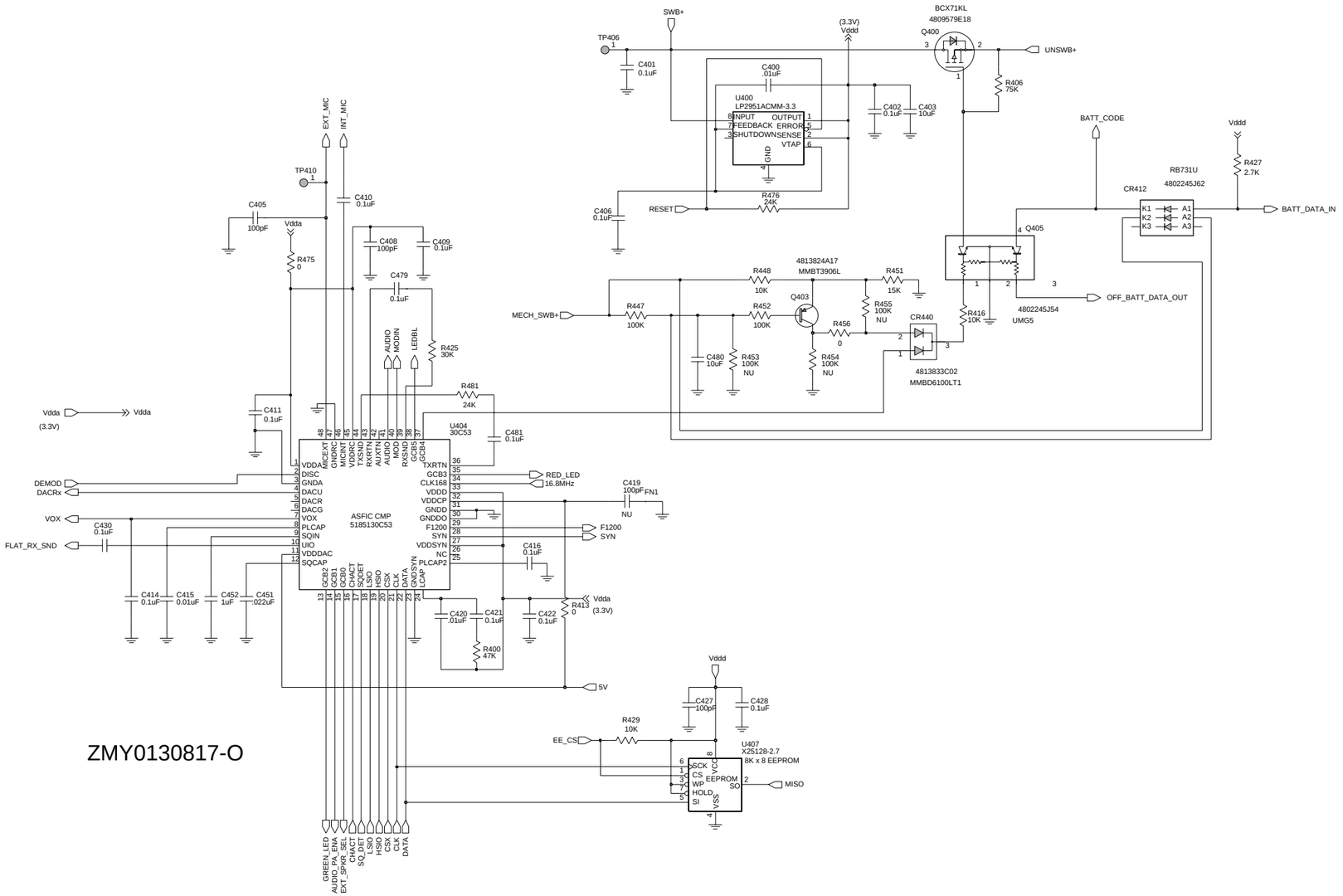


Figure 5-3: Complete Controller Schematic Diagram



ZMY0130817-O

Figure 5-4: Controller ASFIC/ON_OFF Schematic Diagram

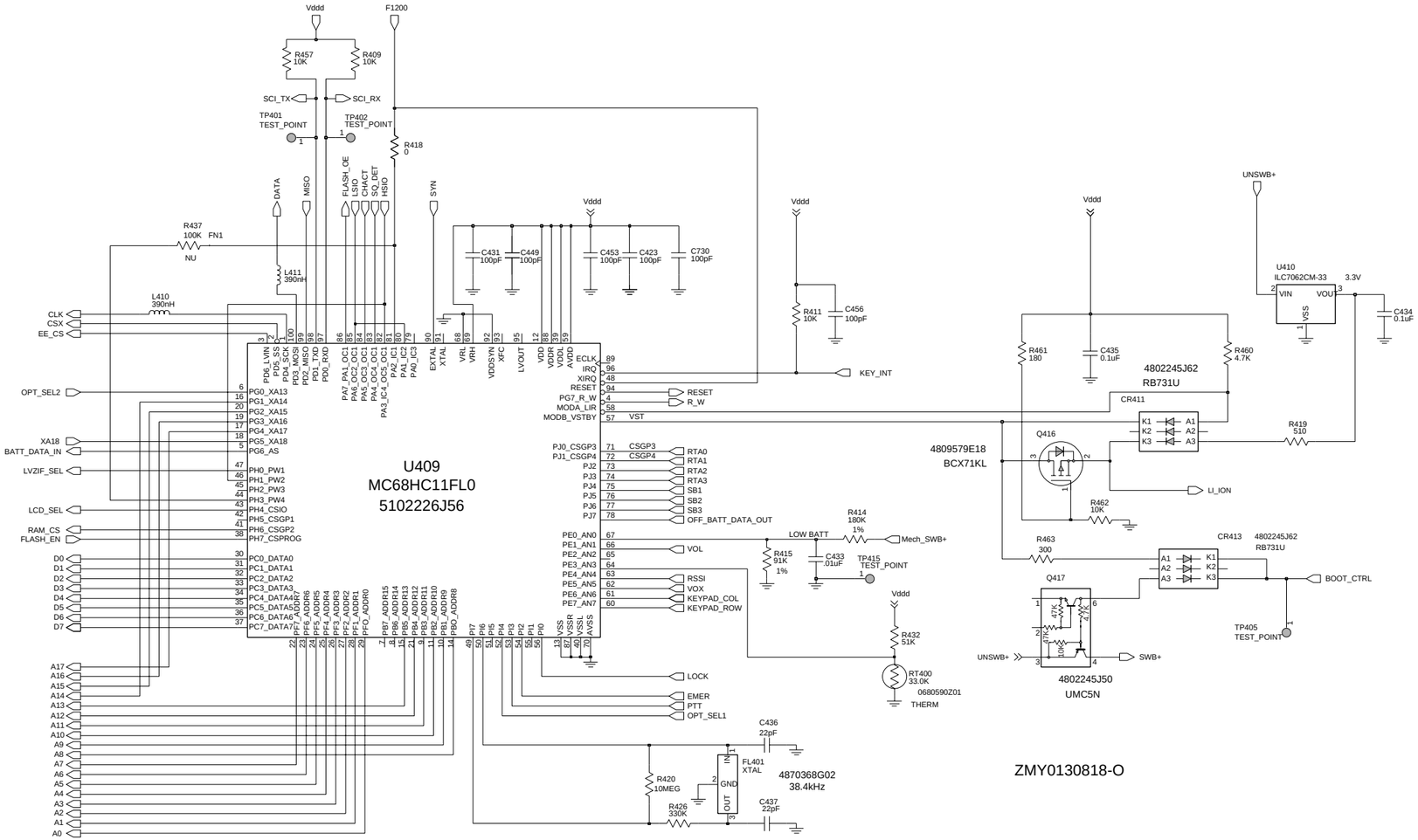


Figure 5-5: Controller Micro Processor Schematic Diagram

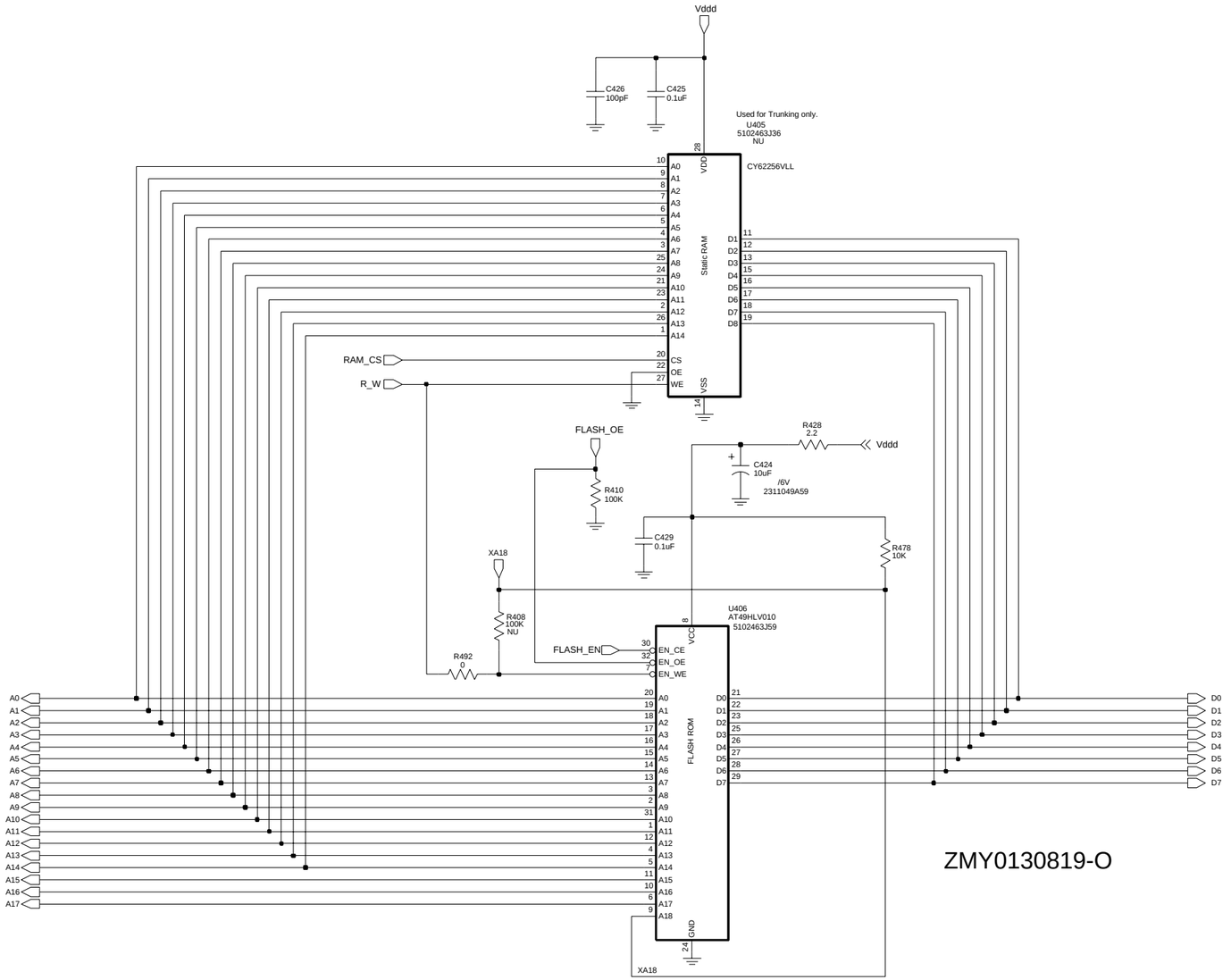


Figure 5-6: Controller Memory Schematic Diagram

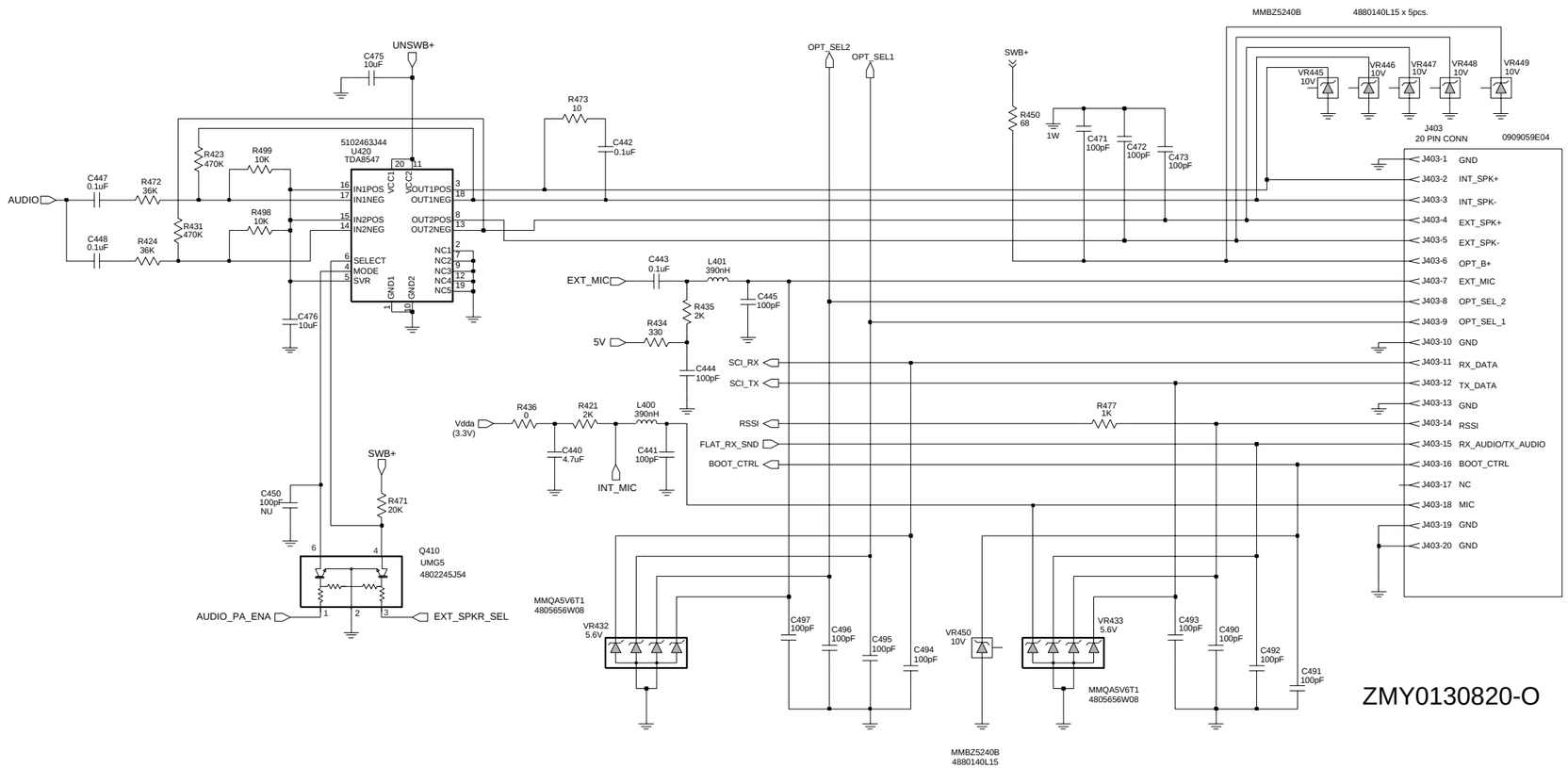


Figure 5-7: Controller Audio Power Amplifer Schematic Diagram

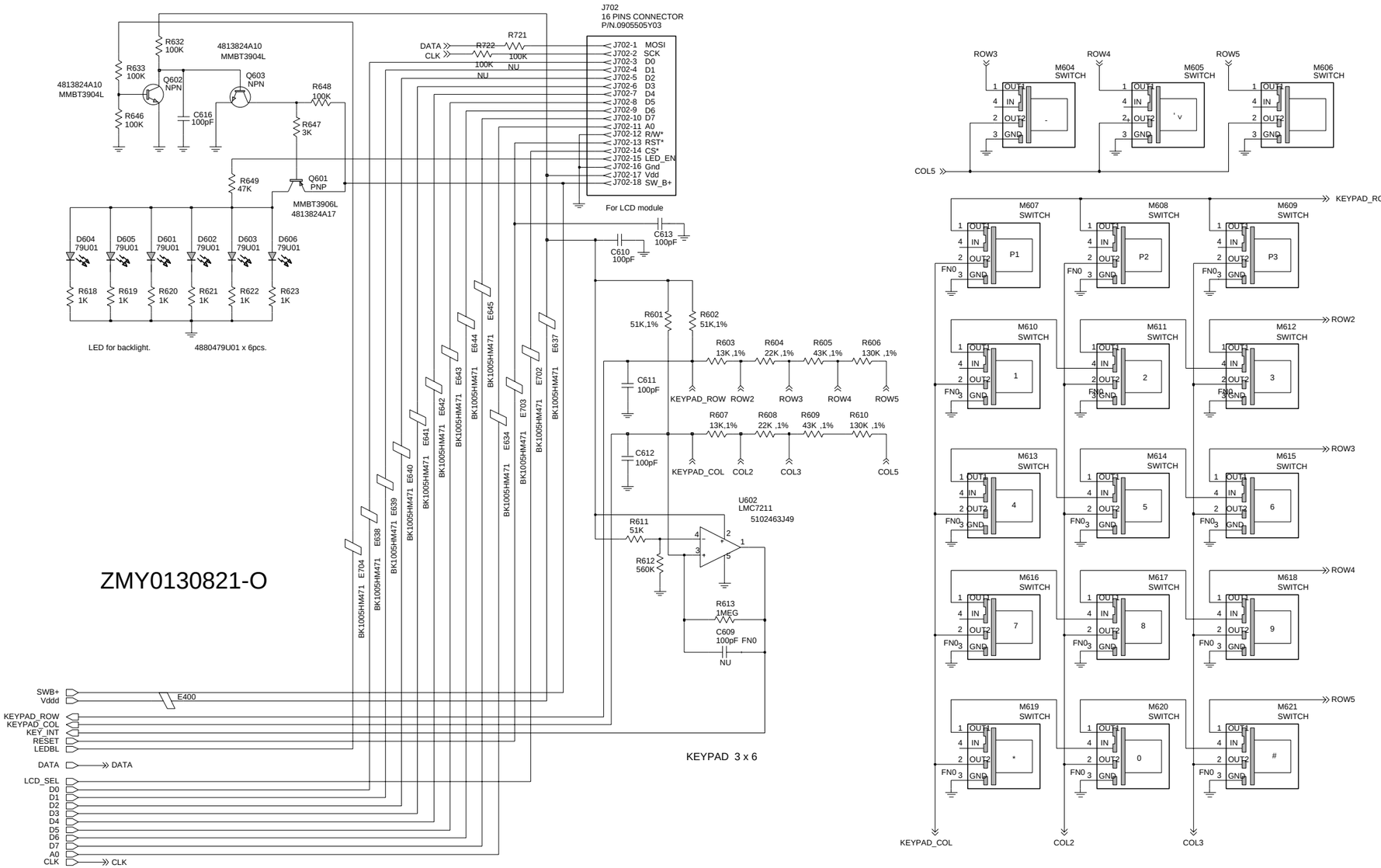


Figure 5-8: Keypad Audio Power Amplifer Schematic Diagram

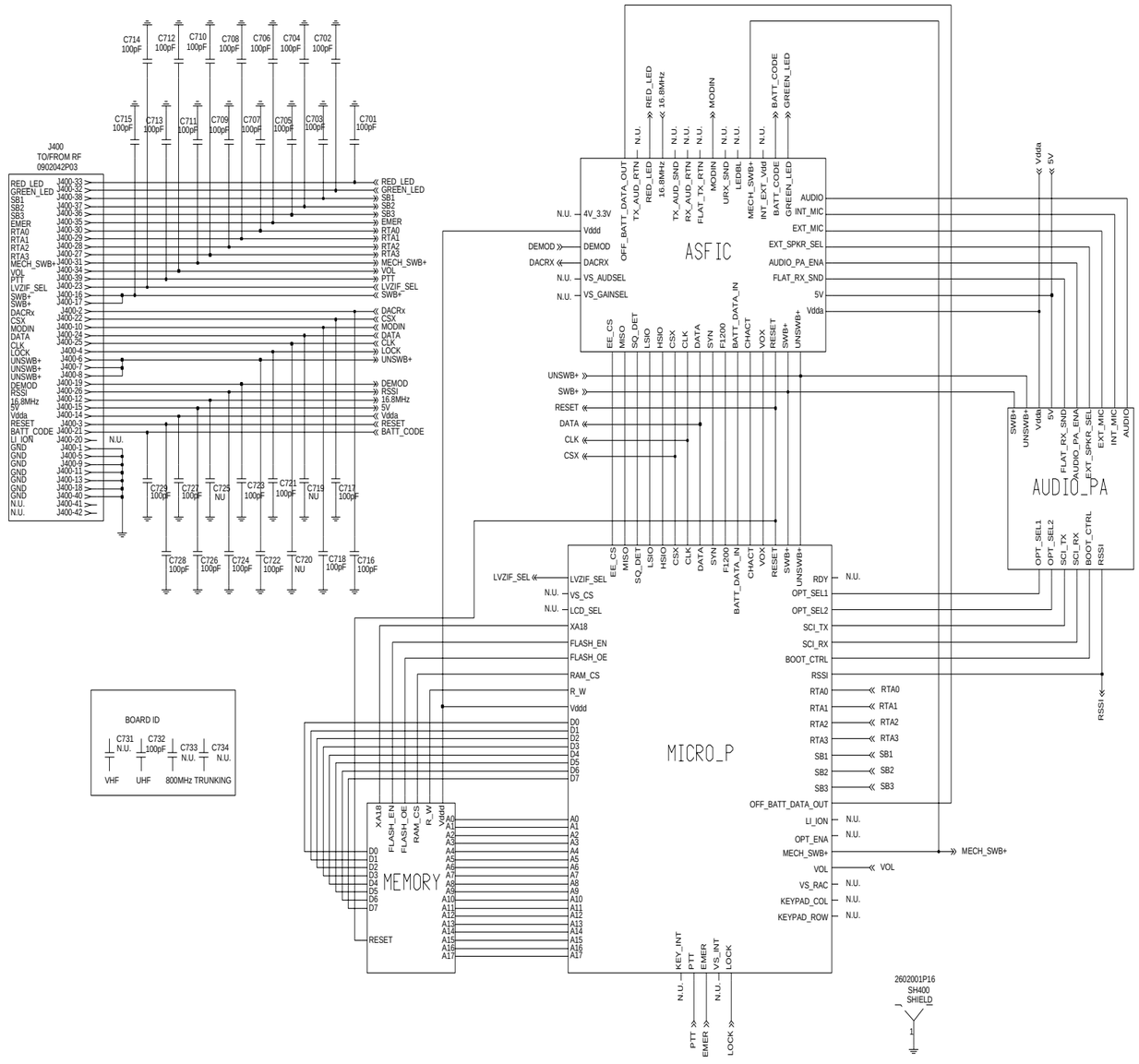


Figure 5-9: Controller Board Bottom View for (PCB No.8404056G07))

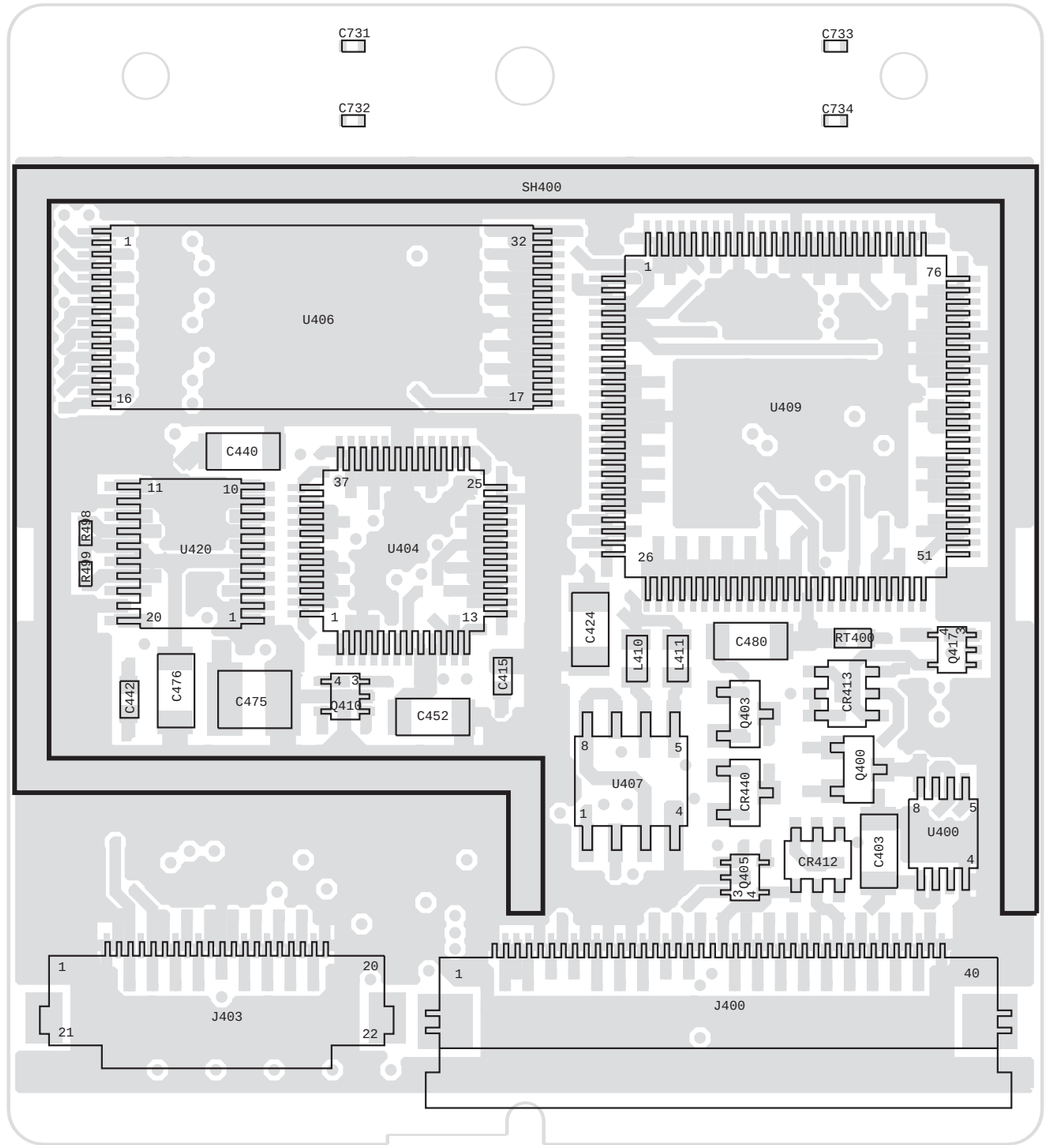


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Figure 5-10: Controller Board Bottom View for (PCB No.8404056G07)

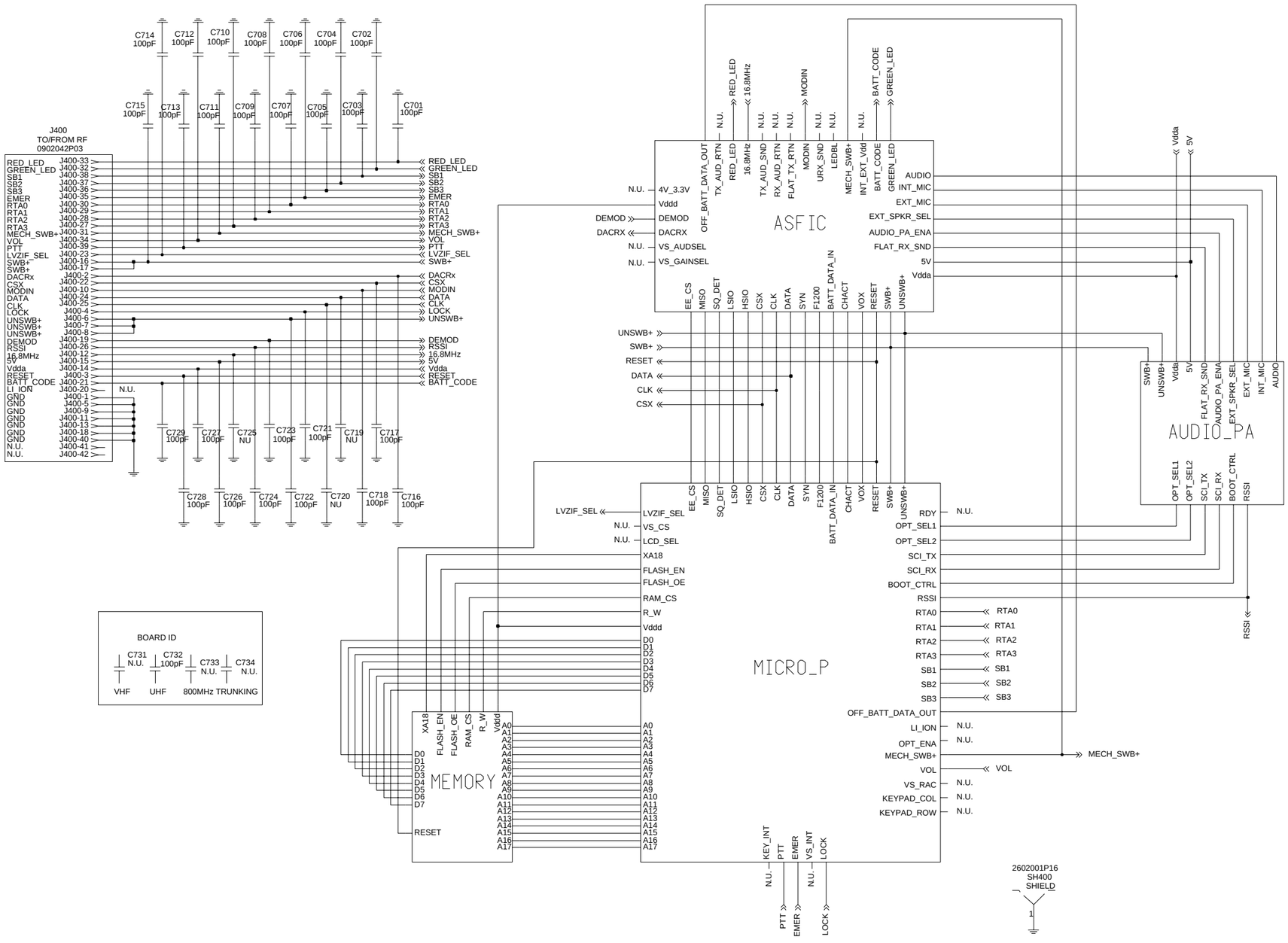

Figure 5-11: Complete Controller Schematic Diagram

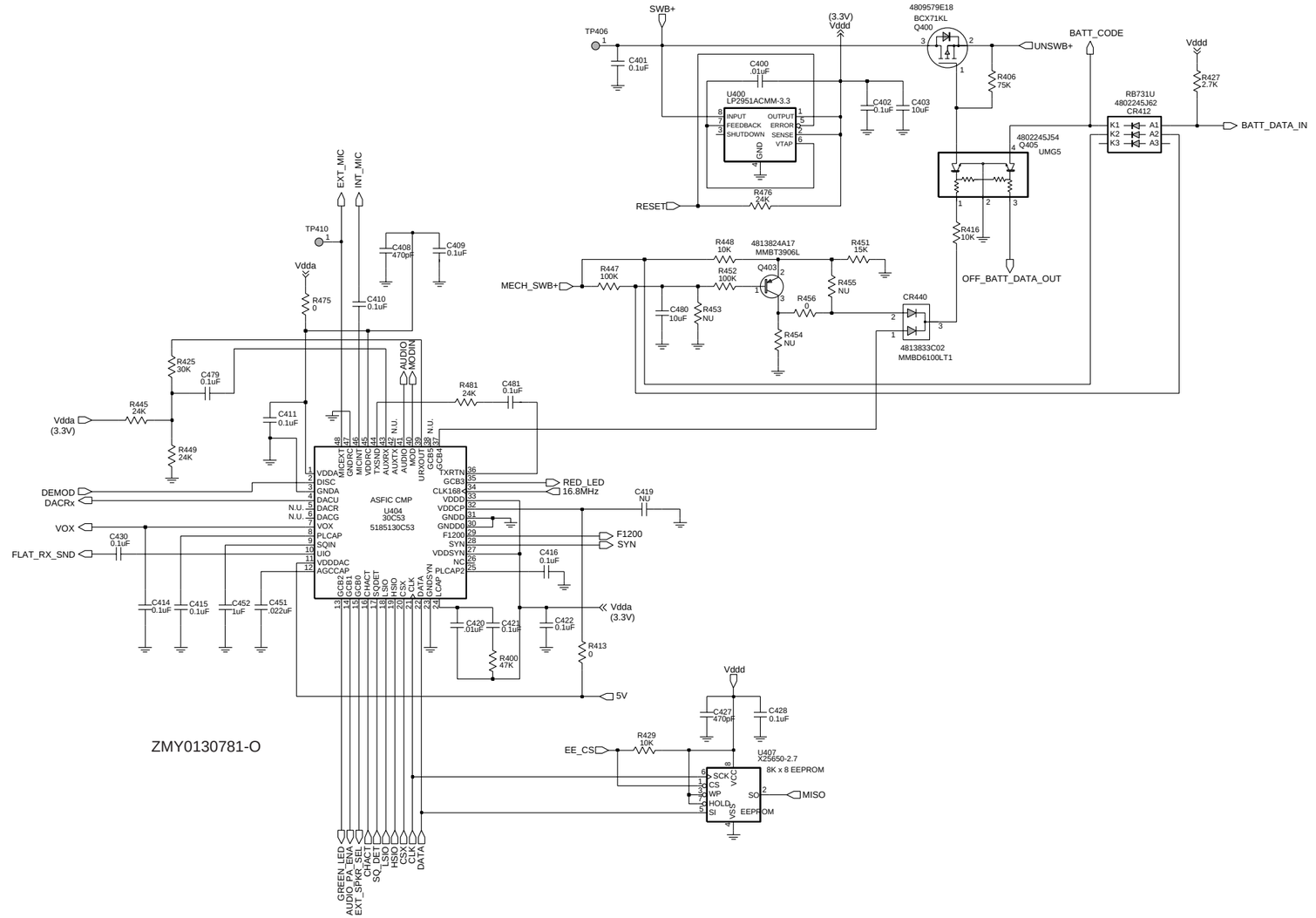

Figure 5-12: Controller ASIF/ON_OFF Schematic Diagram

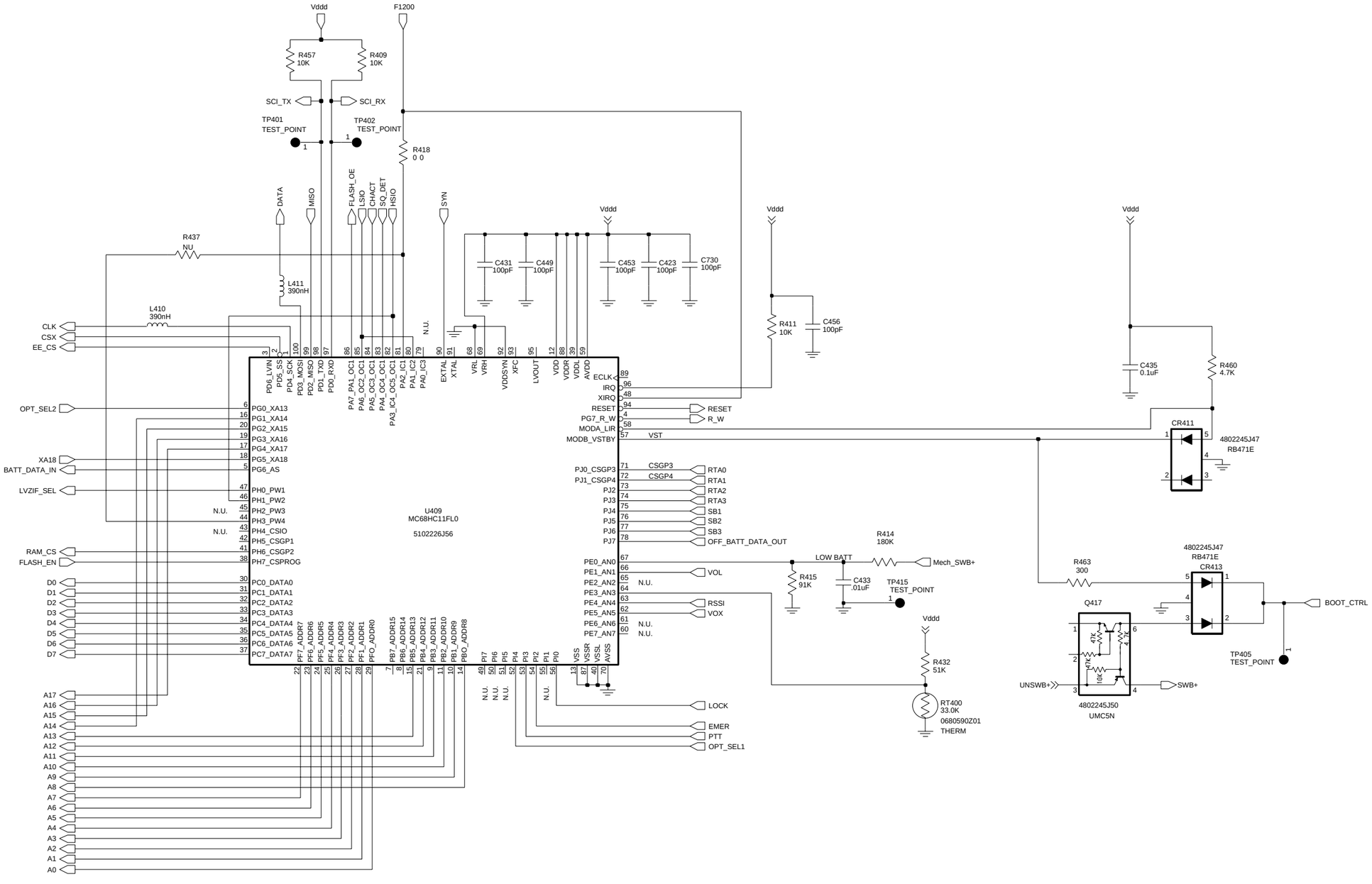

Figure 5-13: Controller Micro Processor Schematic Diagram

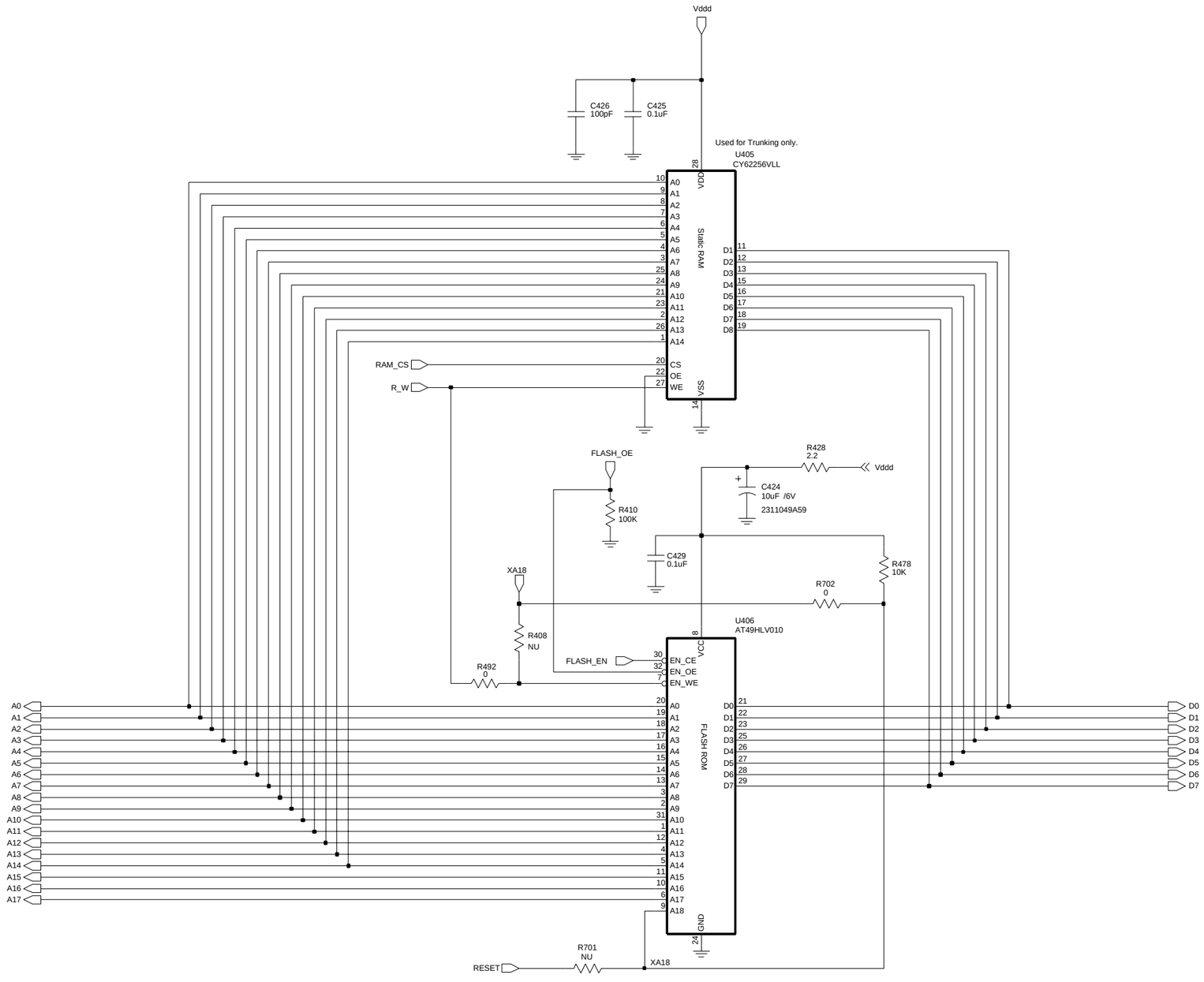

Figure 5-14: Controller Memory Schematic Diagram

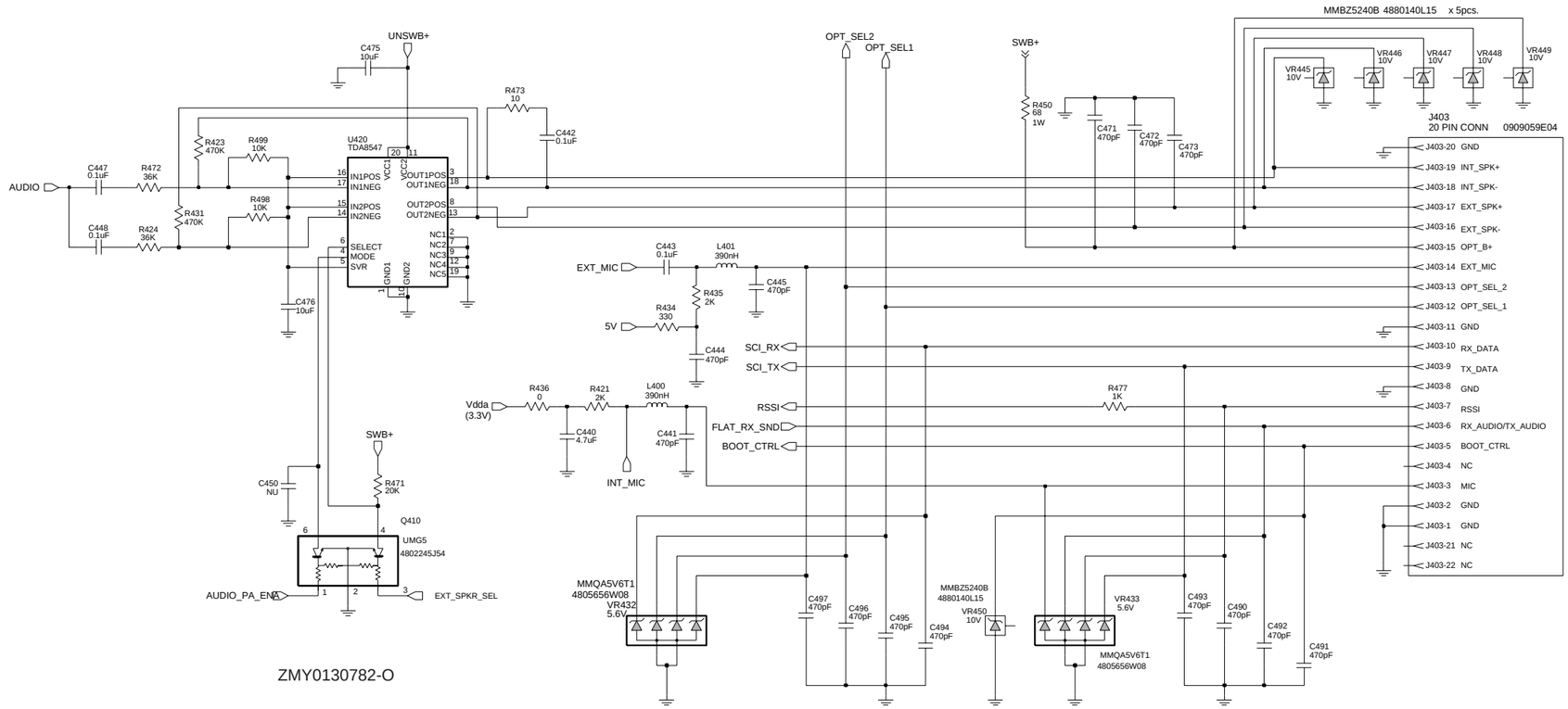

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Figure 5-15: Controller Audio Power Amplifier Schematic Diagram

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6.1 VHF Circuit Board/Schematic Diagrams and Parts List

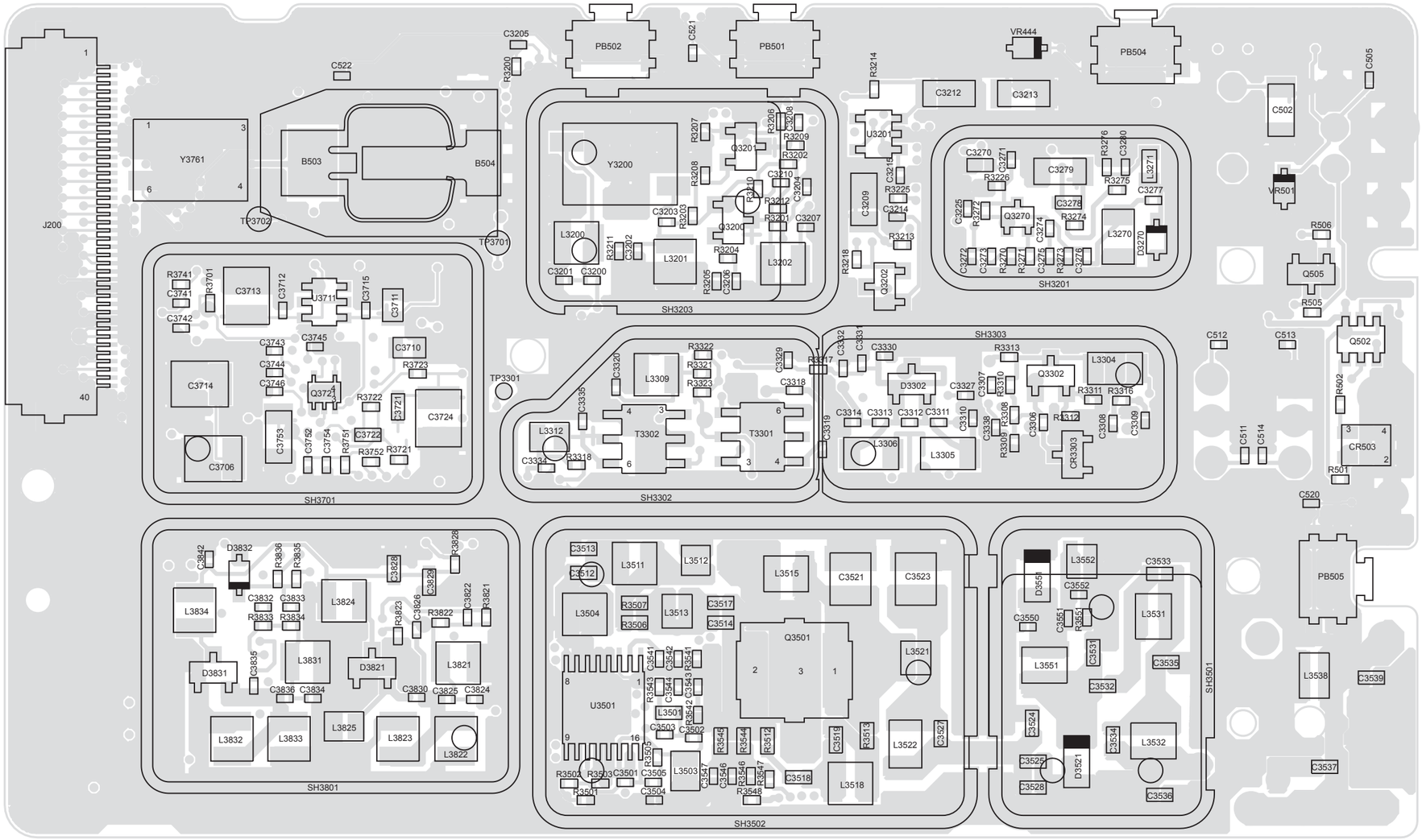

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Figure 6-1: VHF (136-174MHz) Main Board Top Side PCB No. 8486062B12

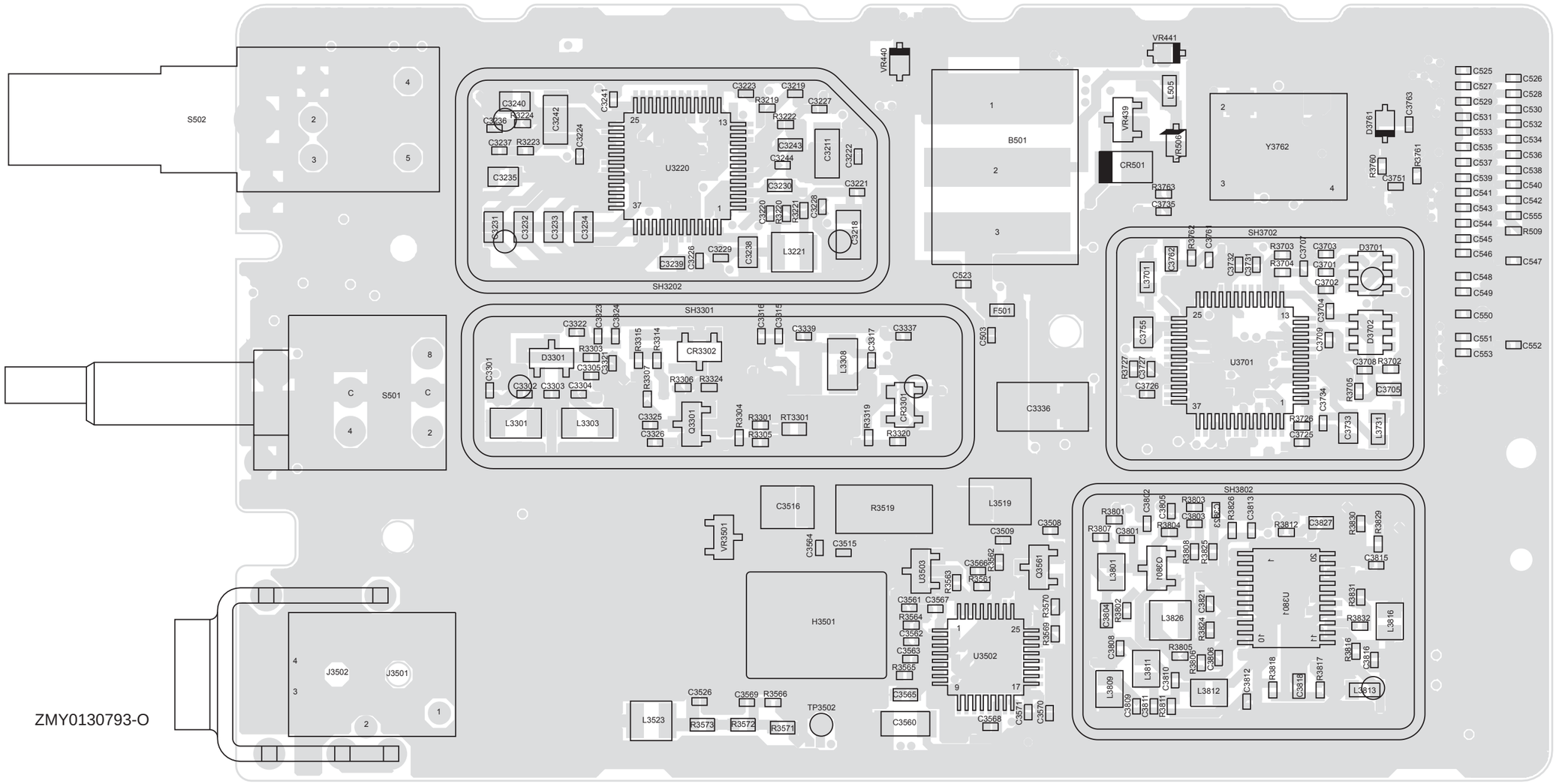
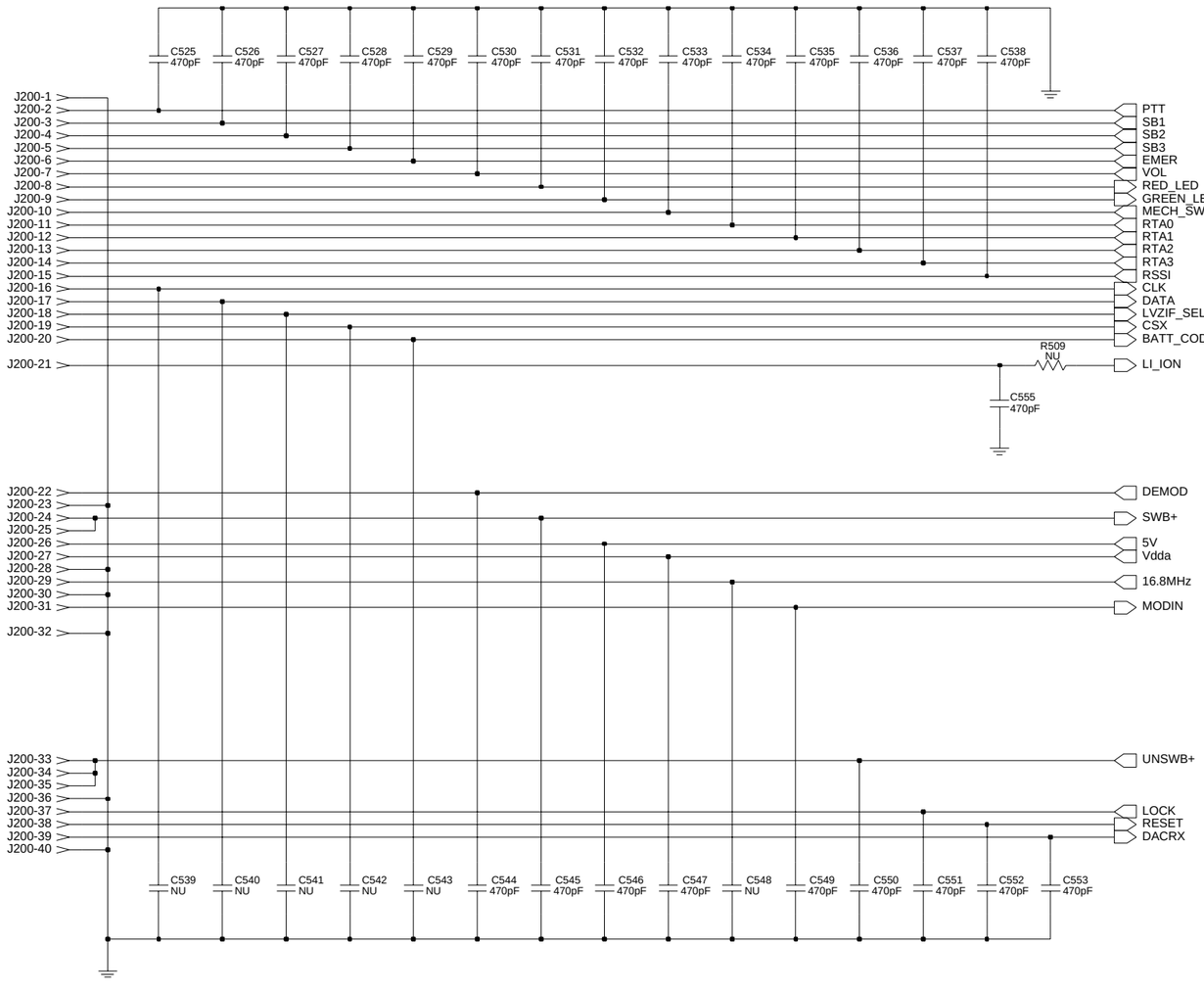
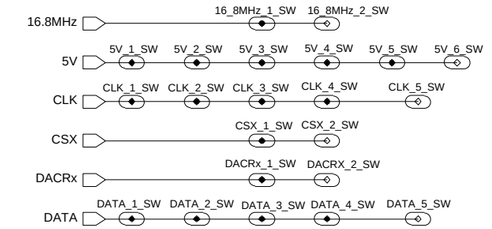
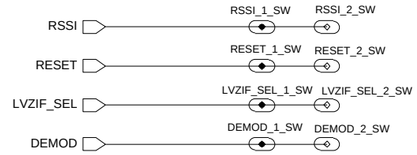


Figure 6-2: VHF (136-174MHz) Main Board Bottom Side PCB No. 8486062B12







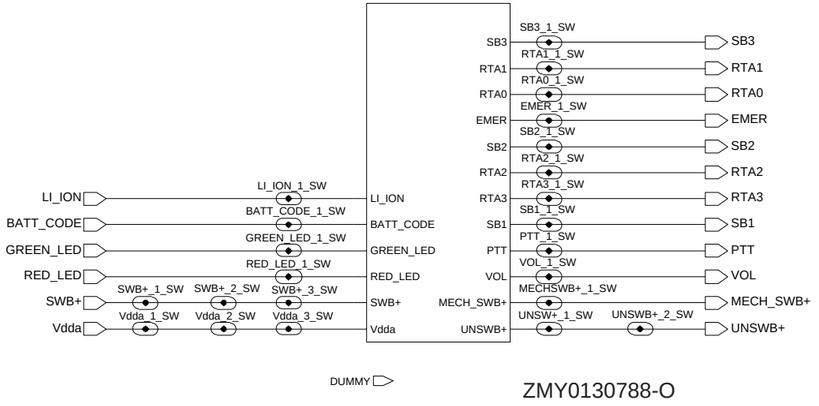


Figure 6-3: VHF Controls And Switches Schematic Diagram

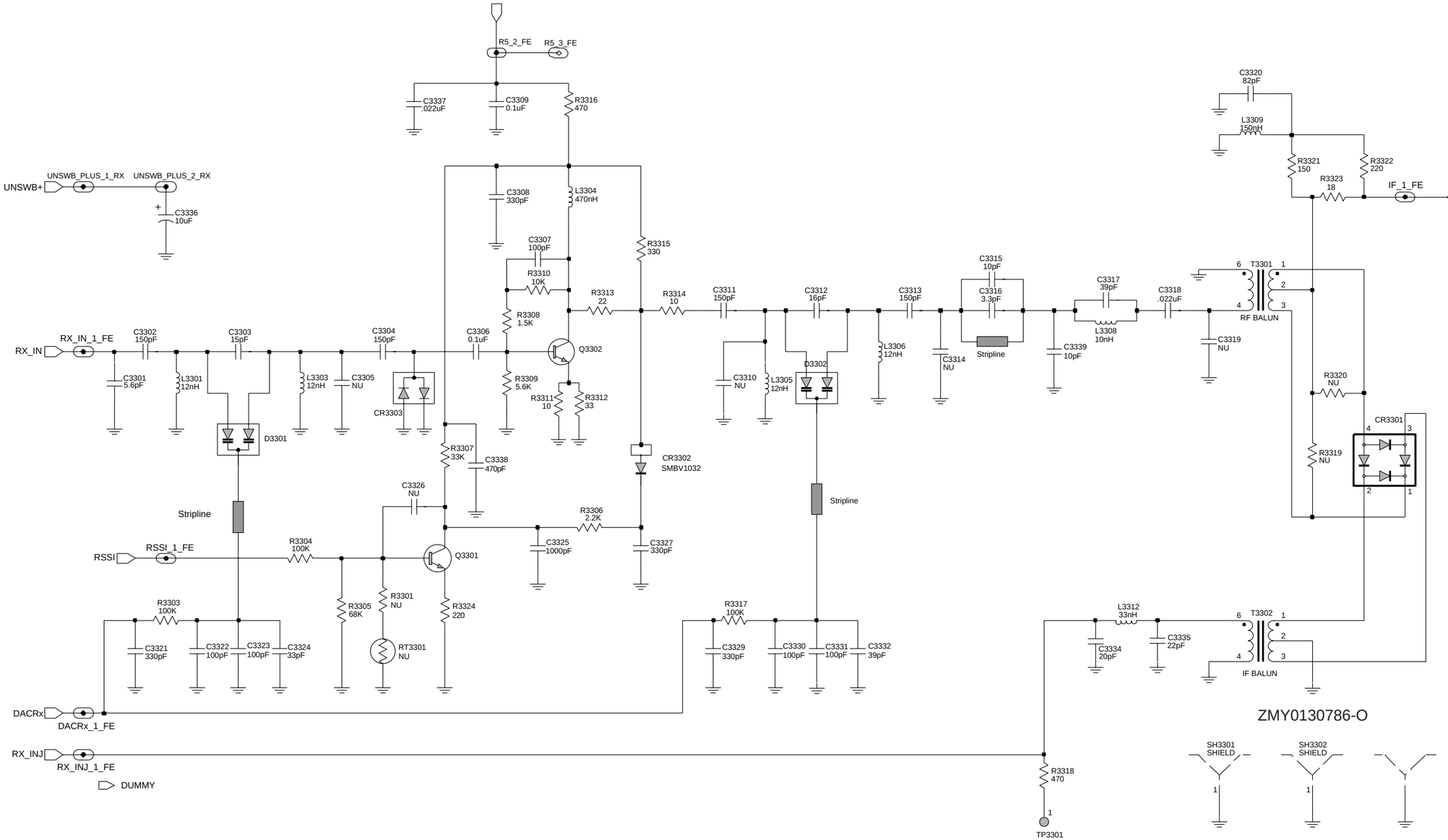


Figure 6-4: VHF Receiver Front End Schematic Diagram

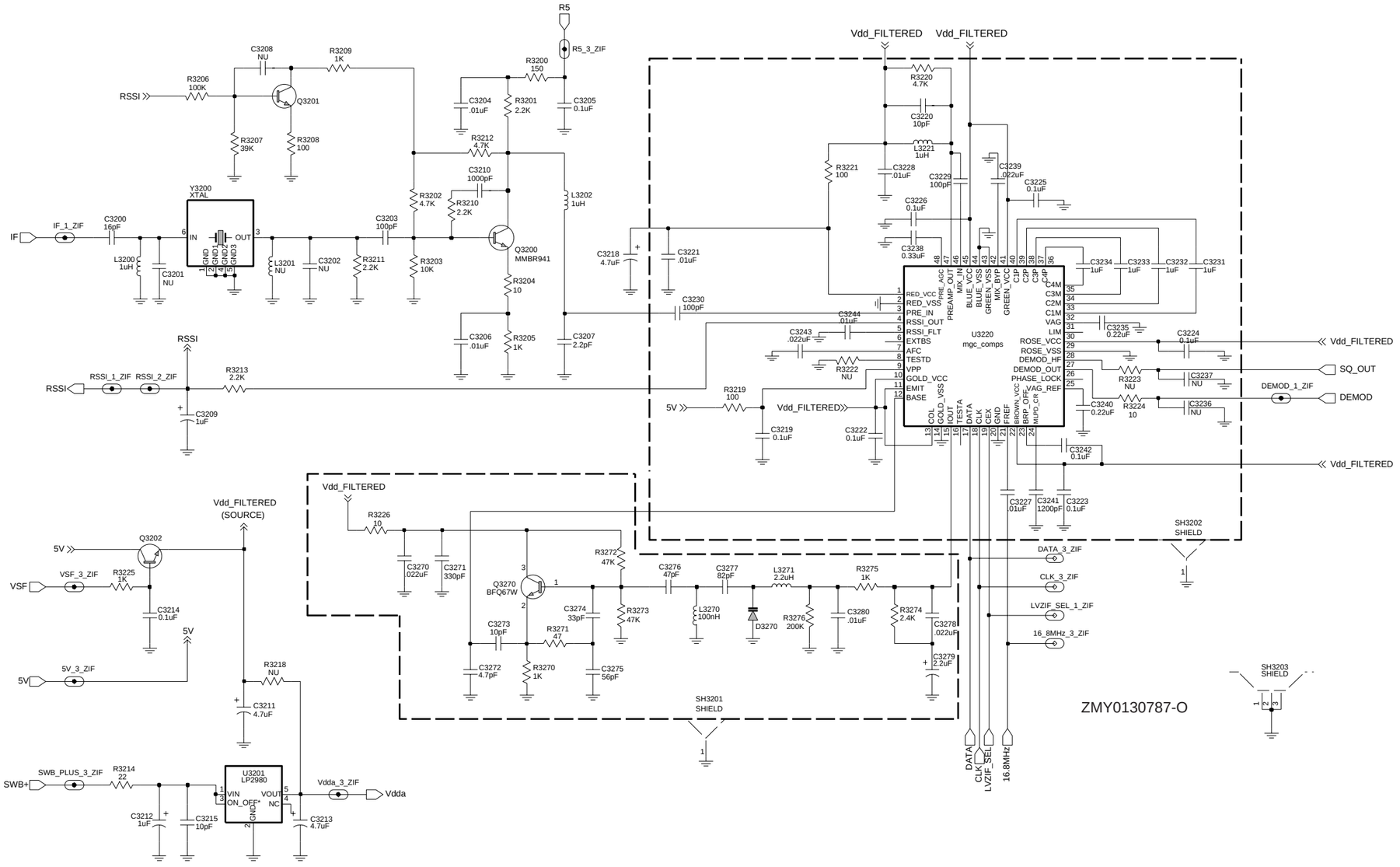


Figure 6-5: VHF Receiver Back End Schematic Diagram

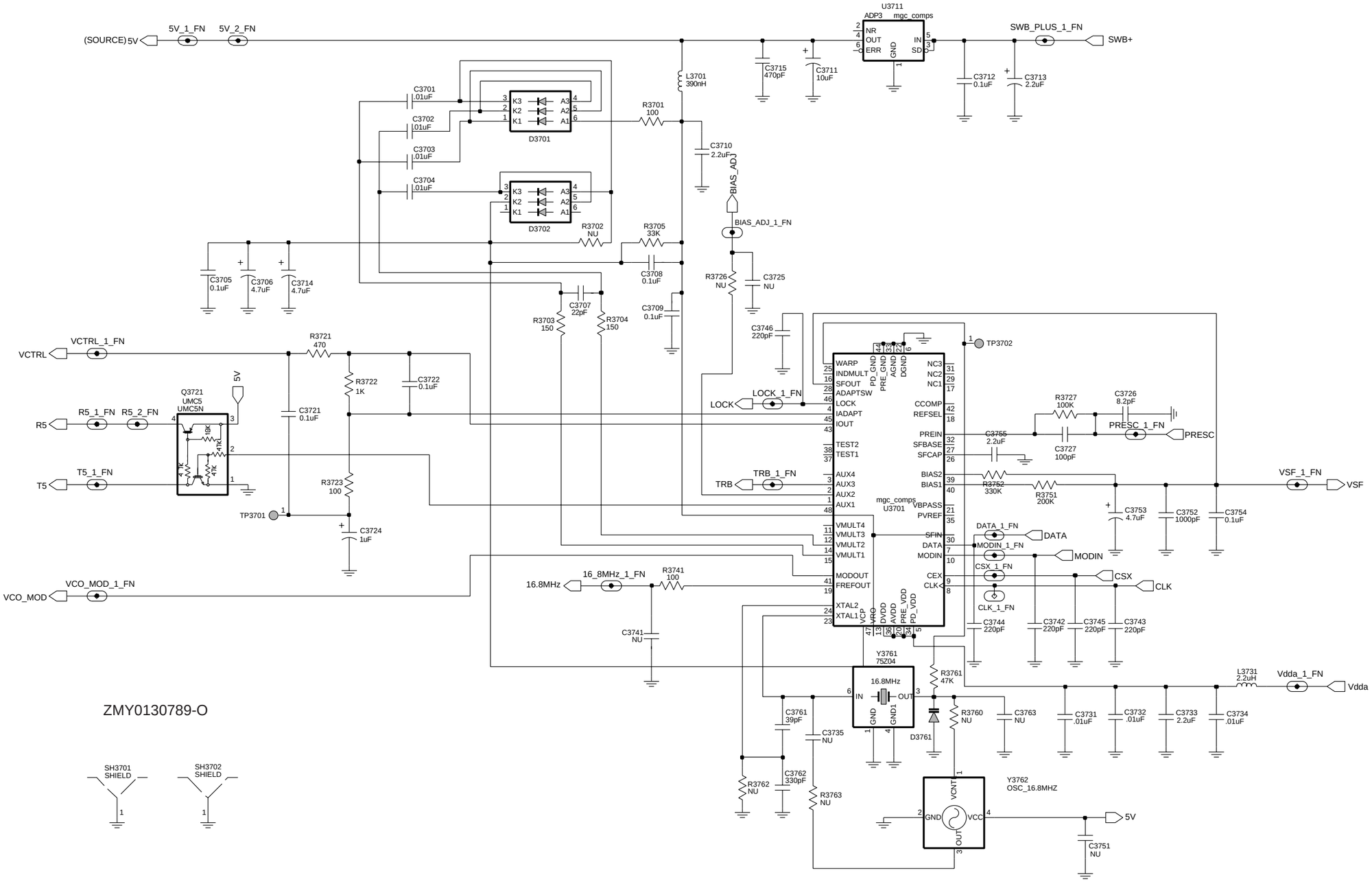


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Figure 6-6: VHF Synthesizer Schematic Diagram

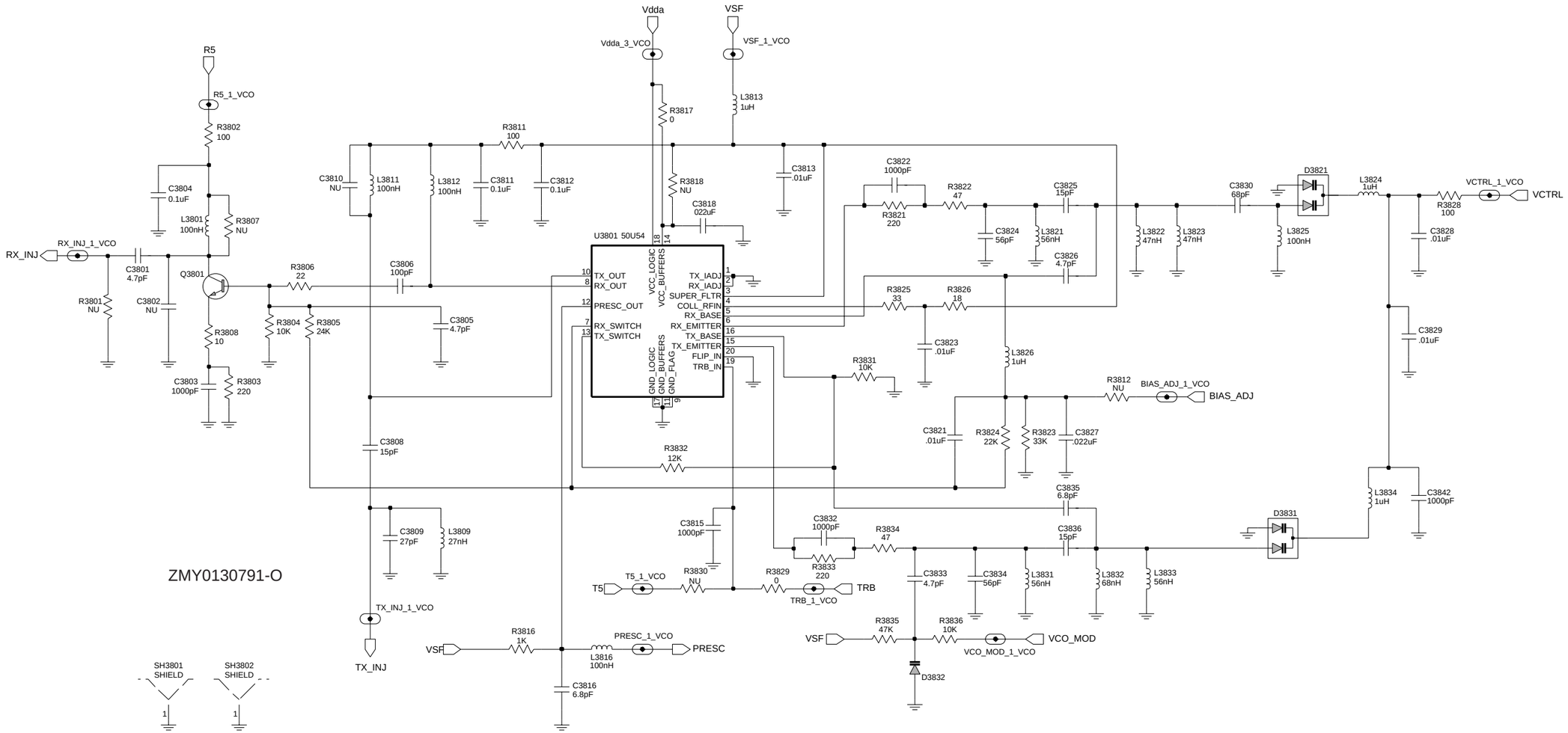

Figure 6-7: VHF Voltage Controlled Oscillator Schematic Diagram

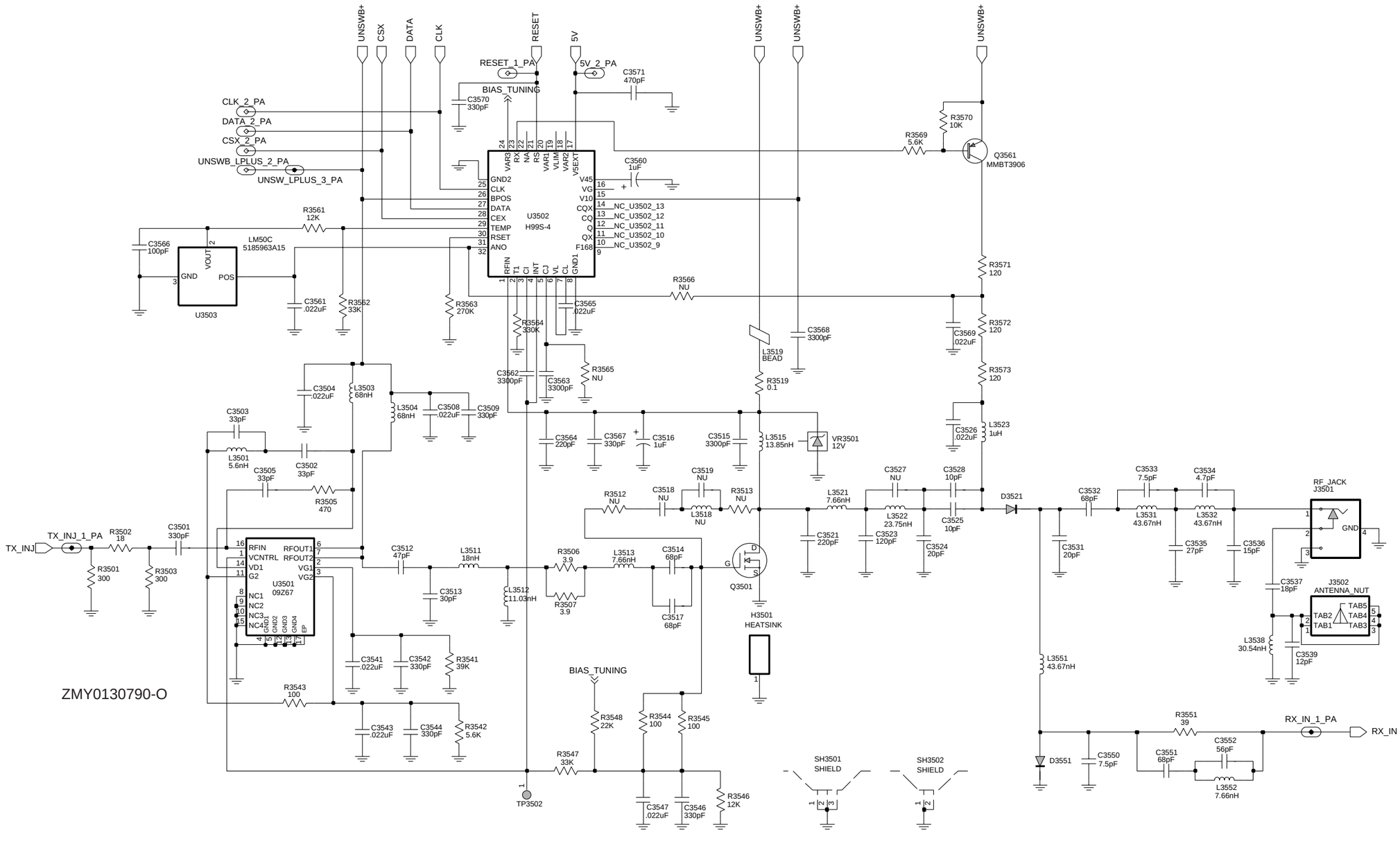

Figure 6-8: VHF Transmitter Schematic Diagram

VHF Radio Parts List

Circuit Ref	Motorola Part No.	Description
B501	0986237A02	Battery Contact Module
C3200	2113743N31	16.0pF
C3203	2113743N50	100pF
C3204	2113743L41	0.01uF
C3205	2113928N01	0.1uF
C3206	2113743L41	0.01uF
C3207	2113743N10	2.2pF
C3209	2311049A07	1uF
C3210	2113743L17	1000pF
C3211	2311049A56	4.7uF
C3212	2311049A07	1uF
C3213	2311049A56	4.7uF
C3214	2113928N01	0.1uF
C3215	2113743N26	10pF
C3218	2311049A56	4.7uF
C3219	2113928N01	0.1uF
C3220	2113743N26	10pF
C3221	2113743L41	0.01uF
C3222	2113928N01	0.1uF
C3223	2113928N01	0.1uF
C3224	2113928N01	0.1uF
C3225	2113928N01	0.1uF
C3226	2113928N01	0.1uF
C3227	2113743L41	0.01uF
C3228	2113743L41	0.01uF
C3229	2113743N50	100pF
C3230	2113740F51	100pF
C3231	2180478Z20	1uF
C3232	2180478Z20	1uF
C3233	2180478Z20	1uF
C3234	2180478Z20	1uF
C3235	2113743A23	0.220uF
C3238	2113743A24	0.330uF
C3239	2113743E07	0.022uF
C3240	2113743A23	0.220uF
C3241	2113743L19	1200pF
C3242	2109720D14	0.1uF
C3243	2113743E07	0.022uF
C3244	2113743L41	0.01uF
C3270	2113743E07	0.022uF
C3271	2113743L05	330pF
C3272	2113743N18	4.7pF
C3273	2113743N26	10pF
C3274	2113743N38	33pF
C3275	2113743N44	56pF
C3276	2113743N42	47.0pF
C3277	2113743N48	82.0pF
C3278	2113743E07	0.022uF
C3279	2311049A40	2.2uF
C3280	2113743L41	0.01uF
C3301	2113743N20	5.6pF
C3302	2113743N54	150pF
C3303	2113743N30	15.0pF
C3304	2113743N54	150pF
C3306	2113928N01	0.1uF
C3307	2113743N50	100pF
C3308	2113743L05	330pF
C3309	2113928N01	0.1uF
C3311	2113743N54	150pF
C3312	2113743N31	16.0pF
C3313	2113743N54	150pF
C3315	2113743N26	10pF
C3316	2113743N14	3.3pF
C3317	2113743N40	39.0pF
C3318	2113743M08	0.022uF
C3320	2113743N48	82.0pF
C3321	2113743L05	330pF
C3322	2113743N50	100pF
C3323	2113743N50	100pF
C3324	2113743N38	33pF
C3325	2113743L17	1000pF
C3327	2113743L05	330pF
C3329	2113743L05	330pF
C3330	2113743N50	100pF
C3331	2113743N50	100pF
C3332	2113743N40	39.0pF
C3334	2113743N33	20pF
C3335	2113743N34	22pF
C3336	2311049A18	10uF
C3337	2113743M08	0.022uF
C3338	2113743L09	470pF
C3339	2113743N26	10pF
C3501	2113743L05	330pF
C3502	2113743N38	33pF
C3503	2113743N38	33pF
C3504	2113743M08	0.022uF
C3505	2113743N38	33pF
C3508	2113743M08	0.022uF
C3509	2113743L05	330pF
C3512	2113740F43	47pF
C3513	2113740F38	30pF
C3514	2113740F67	470pF
C3515	2113743L29	3300pF
C3516	2311049A08	1uF
C3517	2113740F51	100pF
C3518	2113740F63	330pF
C3519	2113740F35	22pF
C3521	2111078B51	220pF
C3523	2111078B44	120pF
C3524	2113740F33	18pF
C3525	2113740F27	10pF
C3526	2113743M08	0.022uF
C3528	2113740F26	9.1pF
C3531	2113740F34	20pF
C3532	2113740F47	68pF
C3533	2113740F24	7.5pF
C3534	2113740F19	4.7pF
C3535	2113740F37	27pF
C3536	2113740F31	15pf
C3537	2113740F33	18pF
C3539	2113740F21	5.6pF
C3541	2113743M08	0.022uF
C3542	2113743L05	330pF
C3543	2113743M08	0.022uF
C3544	2113743L05	330pF
C3546	2113743L05	330pF
C3547	2113743M08	0.022uF
C3550	2113743N23	7.5pF
C3551	2113743N46	68.0pF
C3552	2113743N44	56pF
C3560	2311049A07	1uF
C3561	2113743M08	0.022uF
C3562	2113743L29	3300pF
C3563	2113743L29	3300pF
C3564	2113743L01	220pF
C3565	2113743E07	0.022uF
C3566	2113743N50	100pF
C3567	2113743L05	330pF
C3568	2113743L29	3300pF
C3569	2113743M08	0.022uF
C3570	2113743L05	330pF
C3571	2113743L09	470pF
C3701	2113743L41	0.01uF
C3702	2113743L41	0.01uF
C3703	2113743L41	0.01uF
C3704	2113743L41	0.01uF
C3705	2113743E20	10uF
C3706	2311049J11	4.7uF
C3707	2113743N34	22pF
C3708	2113743M24	0.1uF
C3709	2113743M24	0.1uF
C3710	2104993J02	2.2uF
C3711	2311049A69	10uF
C3712	2113743M24	0.1uF
C3713	2311049A09	2.2uF
C3714	2311049J11	4.7uF
C3715	2113743L09	470pF
C3721	2113743E20	10uF
C3722	2113743E20	10uF
C3724	2311049A08	1uF
C3726	2113743N24	8.2pF
C3727	2113743N50	100pF
C3731	2113743L41	0.01uF
C3732	2113743L41	0.01uF
C3733	2104993J02	2.2uF
C3734	2113743L41	0.01uF
C3742	2113743L01	220pF
C3743	2113743L01	220pF
C3744	2113743L01	220pF
C3745	2113743L01	220pF
C3746	2113743L01	220pF
C3752	2113743L17	1000pF
C3753	2311049A56	4.7uF
C3754	2113743M24	0.1uF
C3755	2104993J02	2.2uF
C3761	2113743N40	39pF
C3762	2113740F63	330pF
C3763	2113743N08	1.6pF
C3801	2113743N18	4.7pF
C3803	2113743L17	1000pF
C3804	2113743E20	10uF
C3805	2113743N18	4.7pF
C3806	2113743N50	100pF
C3808	2113743N30	15.0pF
C3809	2113743N36	27pF
C3811	2113743M24	0.1uF
C3812	2113743M24	0.1uF
C3813	2113743L41	0.01uF
C3815	2113743L17	1000pF
C3816	2113743N22	6.8pF
C3818	2113743E07	0.022uF
C3821	2113743L41	0.01uF
C3822	2113743L17	1000pF
C3823	2113743L41	0.01uF
C3824	2113743N44	56pF
C3825	2113743N30	15.0pF
C3826	2113743N18	4.7pF
C3827	2113743E07	0.022uF
C3828	2109720D01	0.01uF
C3829	2109720D01	0.01uF
C3830	2113743N46	68.0pF
C3832	2113743L17	1000pF
C3833	2113743N18	4.7pF
C3834	2113743N44	56pF
C3835	2113743N22	6.8pF
C3836	2113743N30	15.0pF
C3842	2113743L17	1000pF
C400	2113743L41	0.01uF,10%
C401	2113743M24	0.1uF +80-20%
C402	2113743M24	0.1uF +80-20%
C403	2113928D08	10uF
C408	2113743L09	470 pF 10%

Circuit Ref	Motorola Part No.	Description
C409	2113743M24	0.1uF +80-20%
C410	2113928N01	0.1uF 10%
C411	2113743M24	0.1uF +80-20%
C414	2113743M24	0.1uF +80-20%
C415	2185895Z01	0.1uF
C416	2113928N01	0.1uF 10%
C420	2113743L41	0.01uF,10%
C421	2113928N01	0.1uF 10%
C422	2113743M24	0.1uF +80-20%
C423	2113743L09	470 pF 10%
C424	2311049A59	10UF 10%
C425	2113743M24	0.1uF +80-20%
C426	2113743L09	470 pF 10%
C427	2113743L09	470 pF 10%
C428	2113743M24	0.1uF +80-20%
C429	2113743M24	0.1uF +80-20%
C430	2113928N01	0.1uF 10%
C431	2113743L09	470 pF 10%
C433	2113743L41	0.01uF,10%
C435	2113743M24	0.1uF +80-20%
C440	2113743G26	4.7uF
C441	2113743L09	470 pF 10%
C442	2113743E20	10uF
C443	2113928N01	0.1uF 10%
C444	2113743L09	470 pF 10%
C445	2113743L09	470 pF 10%
C447	2113928N01	0.1uF 10%
C448	2113928N01	0.1uF 10%
C449	2113743L09	470 pF 10%
C451	2113743M08	0.022uF,80%/-20%
C452	2113743B29	1.00 UF
C453	2113743L09	470 pF 10%
C456	2113743L09	470 pF 10%
C471	2113743L09	470 pF 10%
C472	2113743L09	470 pF 10%
C473	2113743L09	470 pF 10%
C475	2113743H14	10.0uF
C476	2113928D08	10uF
C479	2113928N01	0.1uF 10%
C480	2113928D08	10uF
C481	2113928N01	0.1uF 10%
C490	2113743L09	470 pF 10%
C491	2113743L09	470 pF 10%
C492	2113743L09	470 pF 10%
C493	2113743L09	470 pF 10%
C494	2113743L09	470 pF 10%
C495	2113743L09	470 pF 10%
C496	2113743L09	470 pF 10%
C497	2113743L09	470 pF 10%
C502	2311049A05	0.47uF,10%
C503	2113743N50	100pF
C505	2113743N50	100pF
C511	2113743N50	100pF
C512	2113743N50	100pF
C513	2113743N50	100pF
C514	2113743N50	100pF
C520	2113743L41	0.01uF
C521	2113743L41	0.01uF
C522	2113743L41	0.01uF
C523	2113743L41	0.01uF
C525	2113743L09	470pF
C526	2113743L09	470pF
C527	2113743L09	470pF
C528	2113743L09	470pF
C529	2113743L09	470pF
C530	2113743L09	470pF
C531	2113743L09	470pF
C532	2113743L09	470pF
C533	2113743L09	470pF
C534	2113743L09	470pF
C535	2113743L09	470pF
C536	2113743L09	470pF
C537	2113743L09	470pF
C538	2113743L09	470pF
C544	2113743L09	470pF
C545	2113743L09	470pF
C546	2113743L09	470pF
C547	2113743L09	470pF
C549	2113743L09	470pF
C550	2113743L09	470pF
C551	2113743L09	470pF
C552	2113743L09	470pF
C553	2113743L09	470pF
C555	2113743L09	470pF
C701	2113743L09	470 pF 10%
C702	2113743L09	470 pF 10%
C703	2113743L09	470 pF 10%
C704	2113743L09	470 pF 10%
C705	2113743L09	470 pF 10%
C706	2113743L09	470 pF 10%
C707	2113743L09	470 pF 10%
C708	2113743L09	470 pF 10%
C709	2113743L09	470 pF 10%
C710	2113743L09	470 pF 10%
C711	2113743L09	470 pF 10%
C712	2113743L09	470 pF 10%
C713	2113743L09	470 pF 10%
C714	2113743L09	470 pF 10%
C715	2113743L09	470 pF 10%
C716	2113743L09	470 pF 10%
C717	2113743L09	470 pF 10%
C718	2113743L09	470 pF 10%
C721	2113743L09	470 pF 10%
C722	2113743L09	470 pF 10%
C723	2113743L09	470 pF 10%
C724	2113743L09	470 pF 10%
C726	2113743L09	470 pF 10%
C727	2113743L09	470 pF 10%
C728	2113743L09	470 pF 10%
C729	2113743L09	470 pF 10%
C730	2113743L09	470 pF 10%
C731	2113743L09	470 pF 10%
CR3301	4802245J42	Ring Quad Diode
CR3302	4805129M96	SMBV1032
CR3303	4880154K03	Dual Common Anode-Cathode
CR411	4802245J47	Schottky Diode
CR412	4802245J62	Schottky Diode
CR413	4802245J62	Schottky Diode
CR440	4813833C02	Dual Diode Common Cathode
CR501	4880107R01	Rectifier
CR503	4805729G49	LED Red/Yel
D3270	4862824C01	Varactor
D3301	4802081B58	Diode Dual
D3302	4802081B58	Diode Dual
D3521	4880973Z02	Pin Diode
D3551	4880973Z02	Pin Diode
D3701	4802233J09	Triple Diode
D3702	4802233J09	Triple Diode
D3761	4862824C03	Varactor
D3821	4805649Q13	Dual Varactor
D3831	4805649Q13	Dual Varactor
D3832	4862824C01	Varactor
F501	6580542Z01	Fuse 3A
H3501	2680499Z01	HEATSINK
J200	0905505Y04	40 Pins Connector
J3501	0985613Z01	RF JACK
J3502	0280519Z02	Antenna Nut
J400	0902042P03	40 Pins Connector
J403	0909059E04	20 Pins Connector
L3200	2462587N68	1000nH
L3202	2462587N68	1000nH
L3221	2462587N68	1000nH
L3270	2462587T15	100nH
L3271	2462587Q20	2.2uH
L3301	2462587T35	2nH
L3303	2462587T35	2nH
L3304	2462587T23	470nH
L3305	2462587T35	2nH
L3306	2462587T35	2nH
L3308	2462587T34	10nH
L3309	2462587N55	150nH
L3312	2462587V28	33nH
L3501	2413926H09	5.6nH
L3503	2462587V32	68nH
L3504	2462587N51	68nH
L3511	2462587N44	18nH
L3512	2479990B01	11.03nH
L3513	2479990A02	7.66nH
L3515	2479990C03	13.85nH
L3518	2462587N48	39nh
L3519	2484657R01	BEAD
L3521	2479990A02	7.66nH
L3522	2479990E01	23.75nH
L3523	2462587N68	1000nH
L3531	2479990N01	43.67nH
L3532	2479990N01	43.67nH
L3538	2479990M01	30.54nH
L3551	2479990N01	43.67nH
L3552	2479990A02	7.66nH
L3701	2462587Q42	390nH
L3731	2462587Q20	2.2uH
L3801	2462587V34	100nH
L3809	2462587V27	27nH
L3811	2462587V34	100nH
L3812	2462587V34	100nH
L3813	2462587Q47	1uH
L3816	2462587V34	100nH
L3821	2462587N50	56nH
L3822	2462587N49	47nH
L3823	2462587N49	47nH
L3824	2462587N68	1000nH
L3825	2462587V34	100nH
L3826	2462587N68	1000nH
L3831	2462587N50	56nH
L3832	2462587N51	68nH
L3833	2462587N50	56nH
L3834	2462587N68	1000nH
L400	2462587Q42	390NH 10%
L401	2462587Q42	390NH 10%
L410	2462587Q42	390NH 10%
L411	2462587Q42	390NH 10%
L505	2462587Q42	390nH
PB501	4070354A01	Tact Switch
PB502	4070354A01	Tact Switch
PB504	4070354A01	Tact Switch
PB505	4070354A01	Tact Switch
Q3200	4813827A07	MMBR941
Q3201	4880214G02	NPN
Q3202	4880214G02	NPN
Q3270	4805218N63	BFQ67W
Q3301	4880214G02	NPN
Q3302	4813827A07	MMBR942
Q3501	4813828A09	RF Power FET

Circuit Ref	Motorola Part No.	Description
Q3561	4813824A17	PNP
Q3721	4802245J50	UMC5N
Q3801	4813827A07	MMBR943
Q400	4809579E18	MOSFET P-CHAN
Q403	4813824A17	TSTR MMBT3906
Q405	4802245J54	Dual NPN
Q410	4802245J54	Dual NPN
Q417	4802245J50	Dual NPN/PNP
Q502	5180159R01	Dual NPN
Q505	4880214G02	NPN
R3200	0662057M54	150
R3201	0662057M82	2.2K
R3202	0662057M90	4.7K
R3203	0662057M98	10K
R3204	0662057M26	10
R3205	0662057M74	1K
R3206	0662057N23	100K
R3207	0662057N13	39K
R3208	0662057M50	100
R3209	0662057M74	1K
R3210	0662057M82	2.2K
R3211	0662057M82	2.2K
R3212	0662057M90	4.7K
R3213	0662057M82	2.2K
R3214	0662057M34	22
R3219	0662057M50	100
R3220	0662057M90	4.7K
R3221	0662057M50	100
R3224	0662057M26	10
R3225	0662057M74	1K
R3226	0662057M26	10
R3270	0662057M74	1K
R3271	0662057M42	47
R3272	0662057N15	47K
R3273	0662057N15	47K
R3274	0662057M83	2.4K
R3275	0662057M74	1K
R3276	0662057N30	200K
R3303	0662057N23	100K
R3304	0662057N23	100K
R3305	0662057N19	68K
R3306	0662057M82	2.2K
R3307	0662057N11	33K
R3308	0662057M78	1.5K
R3309	0662057M92	5.6K
R3310	0662057M98	10K
R3311	0662057M26	10
R3312	0662057M38	33
R3313	0662057M34	22
R3314	0662057M26	10
R3315	0662057M62	330
R3316	0662057M66	470
R3317	0662057N23	100K
R3318	0662057M66	470
R3321	0662057M54	150
R3322	0662057M58	220
R3323	0662057M32	18
R3324	0662057M58	220
R3501	0662057M61	300
R3502	0662057M32	18
R3503	0662057M61	300
R3505	0662057M62	330
R3512	0662057A27	120
R3513	0662057A25	100
R3519	0680539Z01	0.1
R3542	0662057M92	5.6K
R3543	0662057M50	100
R3544	0662057A25	100
R3545	0662057A25	100
R3546	0662057N11	33K
R3547	0662057N01	12K
R3548	0662057M95	7.5K
R3551	0662057M40	39
R3561	0662057N01	12K
R3562	0662057N11	33K
R3563	0662057N33	270K
R3564	0662057N35	330K
R3569	0662057M92	5.6K
R3570	0662057M98	10K
R3571	0662057A27	120
R3572	0662057A27	120
R3573	0662057A27	120
R3701	0662057M50	100
R3703	0662057M54	150
R3704	0662057M54	150
R3705	0662057N11	33K
R3721	0662057M66	470
R3722	0662057M74	1K
R3723	0662057M50	100
R3727	0662057N23	100K
R3741	0662057M50	100
R3751	0662057N30	200K
R3752	0662057N35	330K
R3761	0662057N15	47K
R3802	0662057M50	100
R3803	0662057M58	220
R3804	0662057M98	10K
R3805	0662057N08	24K
R3806	0662057M34	22
R3808	0662057M26	10
R3811	0662057M50	100
R3816	0662057M74	1K
R3817	0662057M01	0
R3821	0662057M58	220
R3822	0662057M42	47
R3823	0662057N11	33K
R3824	0662057N07	22K
R3825	0662057M38	33
R3826	0662057M32	18
R3828	0662057M50	100
R3829	0662057M01	0
R3831	0662057M98	10K
R3832	0662057N01	12K
R3833	0662057M58	220
R3834	0662057M42	47
R3835	0662057N15	47K
R3836	0662057M98	10K
R400	0662057N15	47K
R406	0662057N20	75K
R409	0662057M98	10K
R410	0662057N23	100K
R411	0662057M98	10K
R413	0662057M01	0
R414	0662057V34	180K
R415	0662057V26	91K
R416	0662057N13	39K
R418	0662057M01	0
R421	0662057M81	2K
R423	0662057N39	470K
R424	0662057N12	36K
R425	0662057N10	30K
R427	0662057M84	2.7K
R428	0662057M10	2.2
R429	0662057M98	10K
R431	0662057N39	470K
R432	0662057N16	51K
R434	0662057M62	330
R435	0662057M81	2K
R436	0662057M01	0
R445	0662057N08	24K
R446	0662057N31	220K
R447	0662057N51	1.5MEG
R448	0662057N33	270K
R449	0662057N08	24K
R450	0683962T45	68,1 W
R451	0662057N03	15K 5%
R457	0662057M98	10K
R460	0662057M90	4.7K
R463	0662057M61	300
R471	0662057M92	5.6K
R472	0662057N12	36K
R473	0662057M26	10
R475	0662057M01	0
R476	0662057N08	24K
R477	0662057M74	1K
R478	0662057M98	10K
R481	0662057N08	24K
R492	0662057M01	0
R498	0662057M98	10K
R499	0662057M98	10K
R501	0662057M70	680
R502	0662057M56	180
R505	0662057M98	10K
R506	0662057N15	47K
R702	0662057M01	0
RT400	0680590Z01	Thermistor 33K
S501	4080710Z01	Freq Switch
S502	1880619Z02	Volume Switch
SH3201	2602023X08	SHIELD
SH3202	2686081B02	SHIELD
SH3203	2686081B03	SHIELD
SH3301	2686081B01	SHIELD
SH3302	2686081B05	SHIELD
SH3303	2686081B06	SHIELD
SH3501	2686081B03	SHIELD
SH3502	2686081B04	SHIELD
SH3701	2680511Z01	SHIELD
SH3702	2680511Z01	SHIELD
SH3801	2680513Z01	SHIELD
SH3802	2680514Z01	SHIELD
SH400	2602001P16	Aoba Ctrl Shield
T3301	2580541Z02	XFMR Coil
T3302	2580541Z02	XFMR Coil
U3201	5102463J58	LP2980
U3220	5109632D83	LVZIF
U3501	5185130C65	LDMOS Driver
U3502	5185765B28	PCIC
U3503	5185963A15	Temperature Sense
U3701	5185963A27	LVFRACN
U3711	5105739X05	Regulator Linear
U3801	5105750U54	VCO IC
U3802	2113743L17	1000pF
U400	5102463J40	3.3V Reg
U404	5185130C53	Asfic Cmp
U406	5102463J59	Flash Rom 256K
U407	5102463J62	EEPROM 16Kx8
U409	5102226J56	uP HC11FLO
U420	5102463J44	Audio Pa
VR432	4805656W08	5.6V Zener
VR433	4805656W08	5.6V Zener
VR439	4880140L17	12V Zener
VR445	4880140L15	10V ZENER
VR446	4880140L15	10V ZENER
VR447	4880140L15	10V ZENER

Circuit Ref	Motorola Part No.	Description
VR448	4880140L15	10V ZENER
VR449	4880140L15	10V ZENER
VR450	4880140L15	10V ZENER
VR501	4813830A18	6.8V Zener
VR506	4802245J73	6.8 Zener
Y3200	9186153B01	XTAL
Y3761	4805875Z04	XTAL 16.8MHz

* Motorola Depot Servicing only

7.1 UHF Band 1, Circuit Board/Schematic Diagrams and Parts List

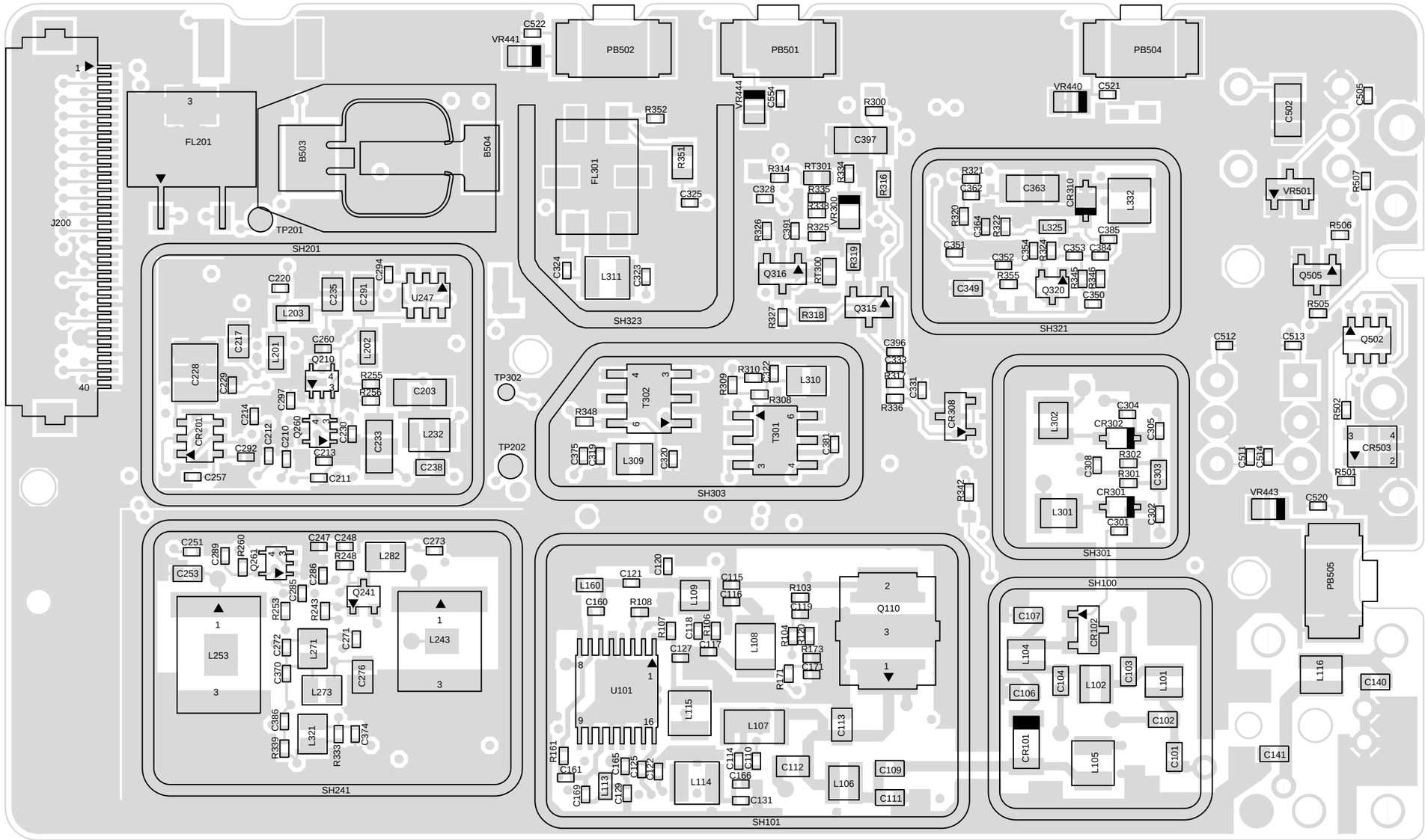

Figure 7-1: UHF (403-470MHz) Main Board Top Side PCB No. 8404077G01

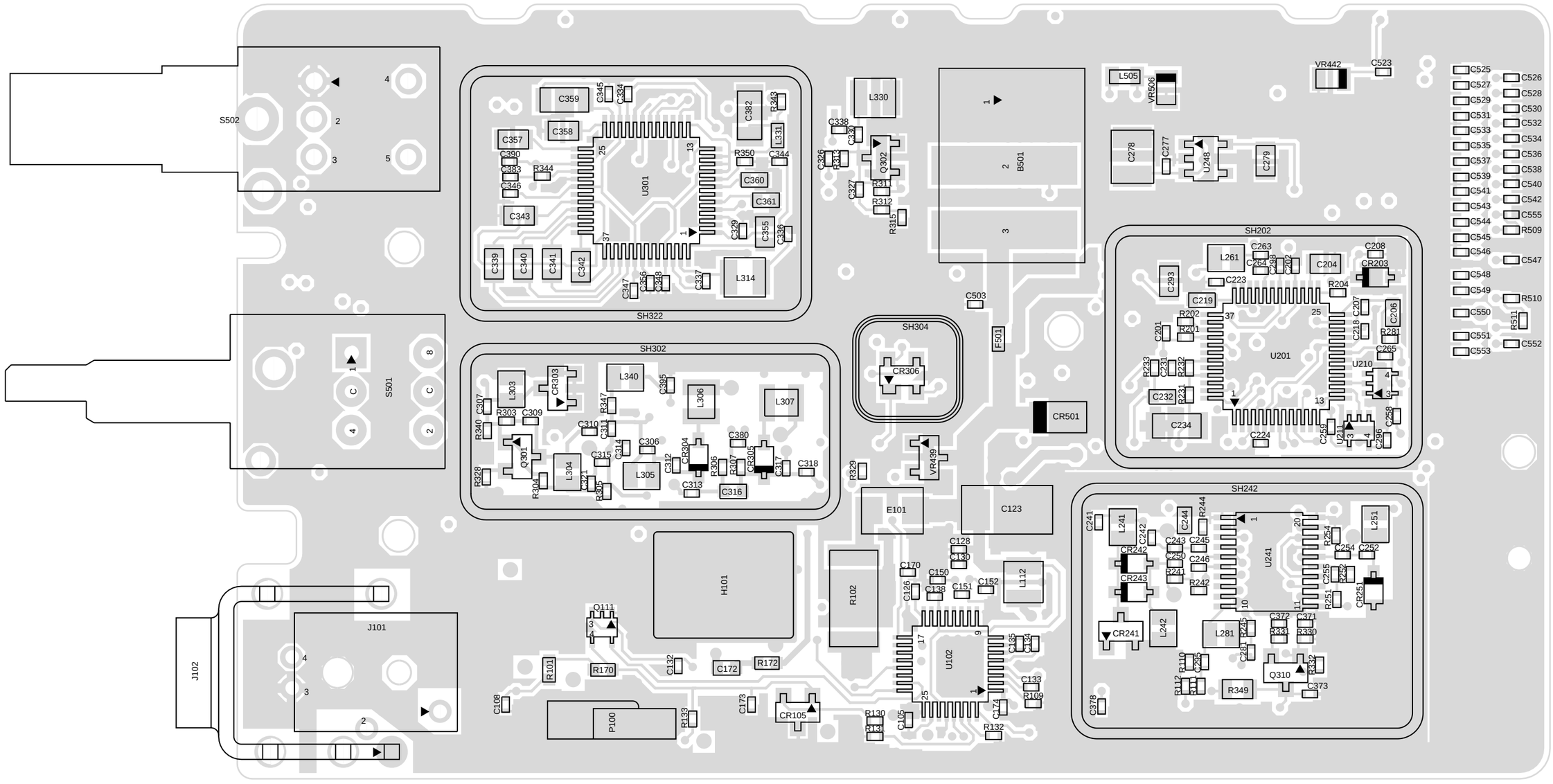

Figure 7-2 : UHF (403-470MHz) Main Board Bottom Side PCB No. 8404077G01

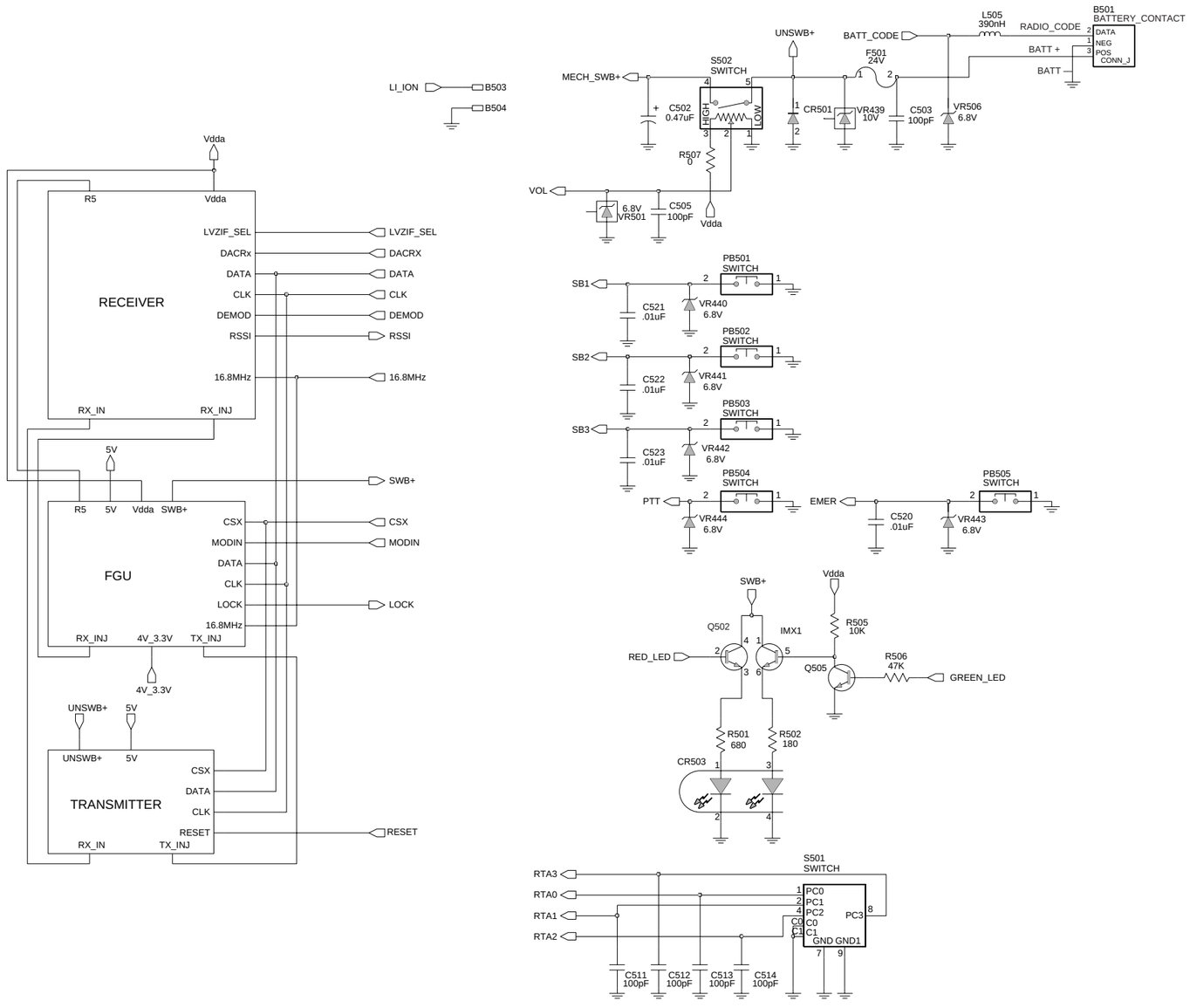

Figure 7-3: UHF Controls And Switches Schematic Diagram

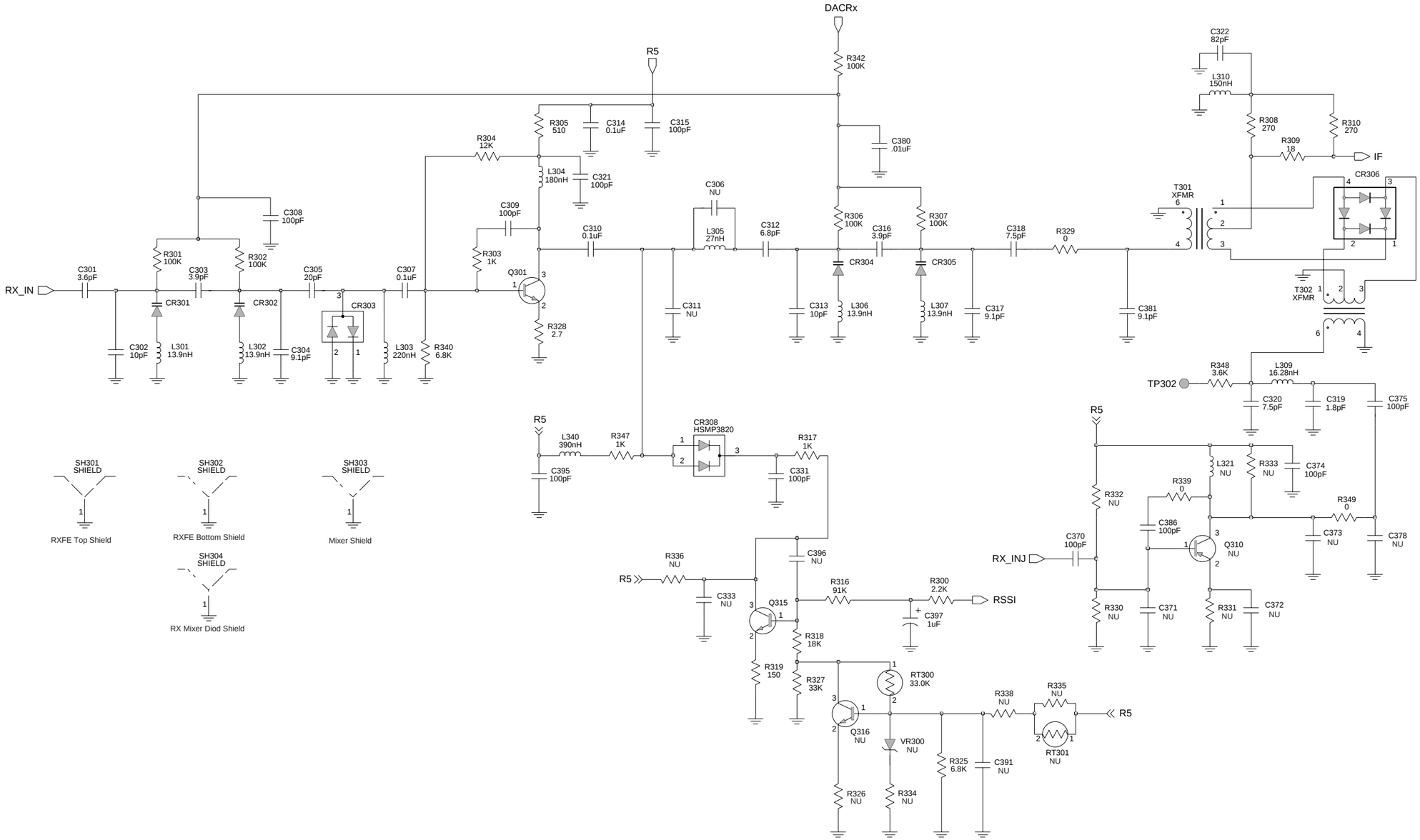

Figure 7-4: UHF Receiver Front End Schematic Diagram

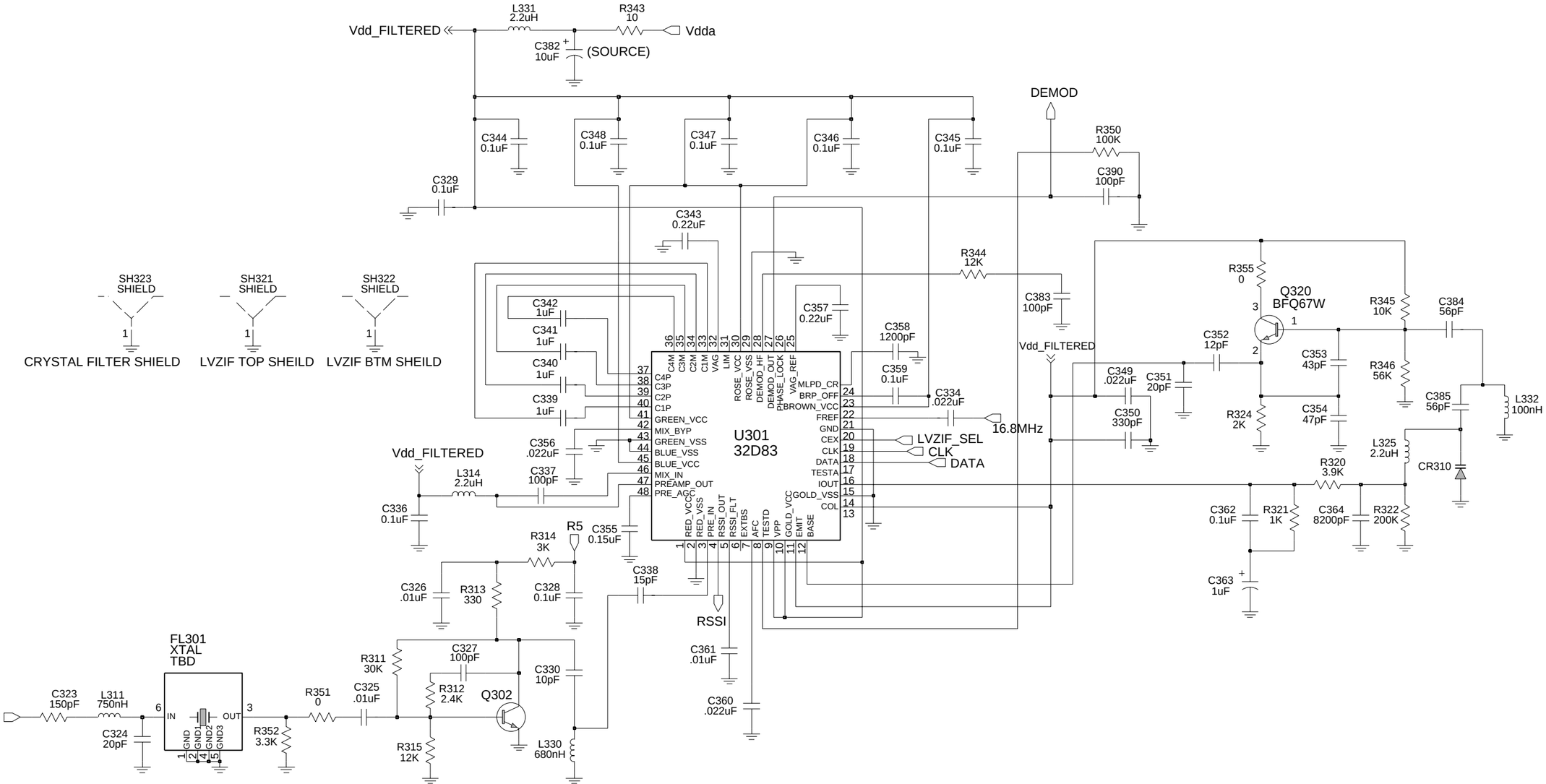

Figure 7-5: UHF Receiver Back End Schematic Diagram

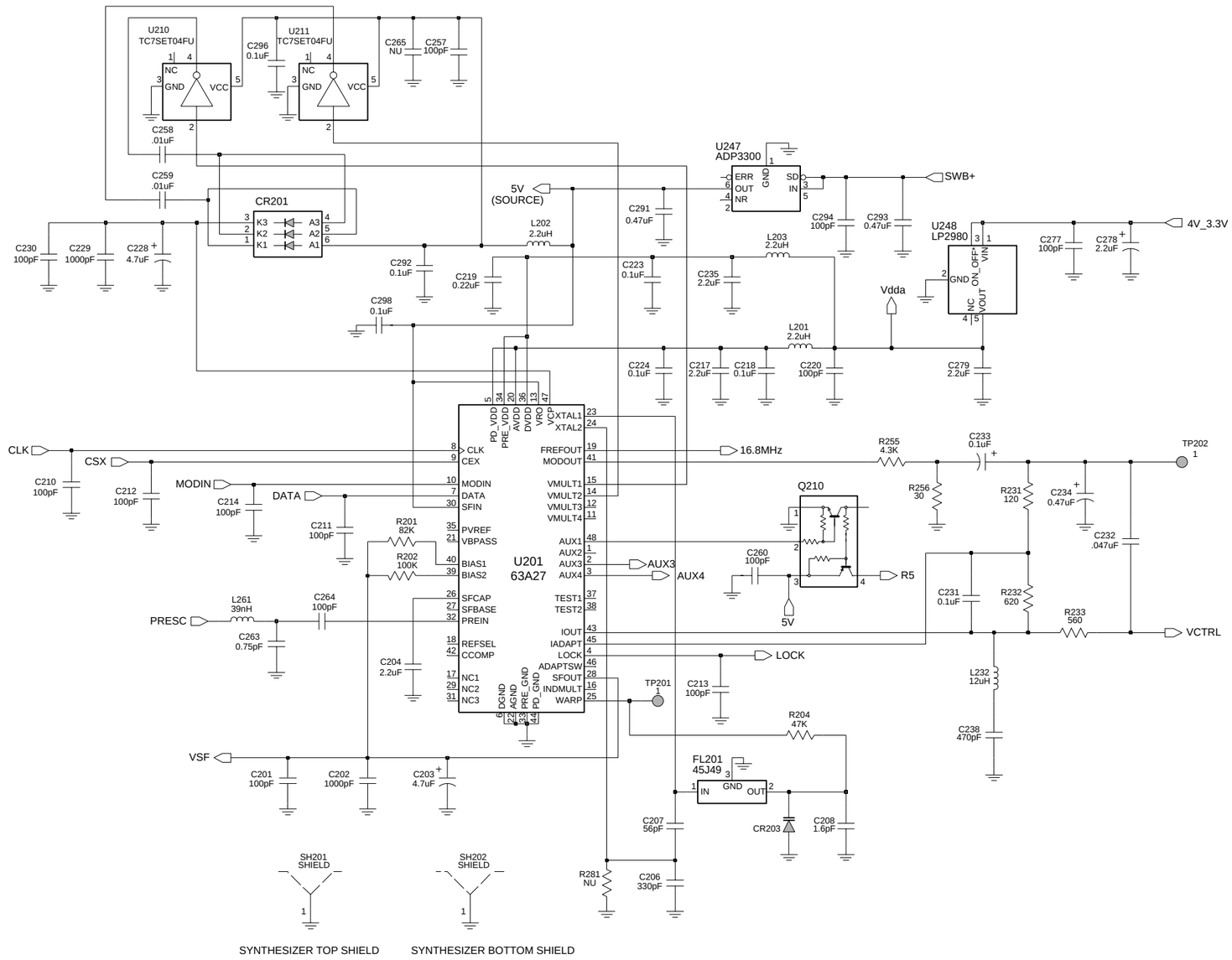

Figure 7-6: UHF Synthesizer Schematic Diagram

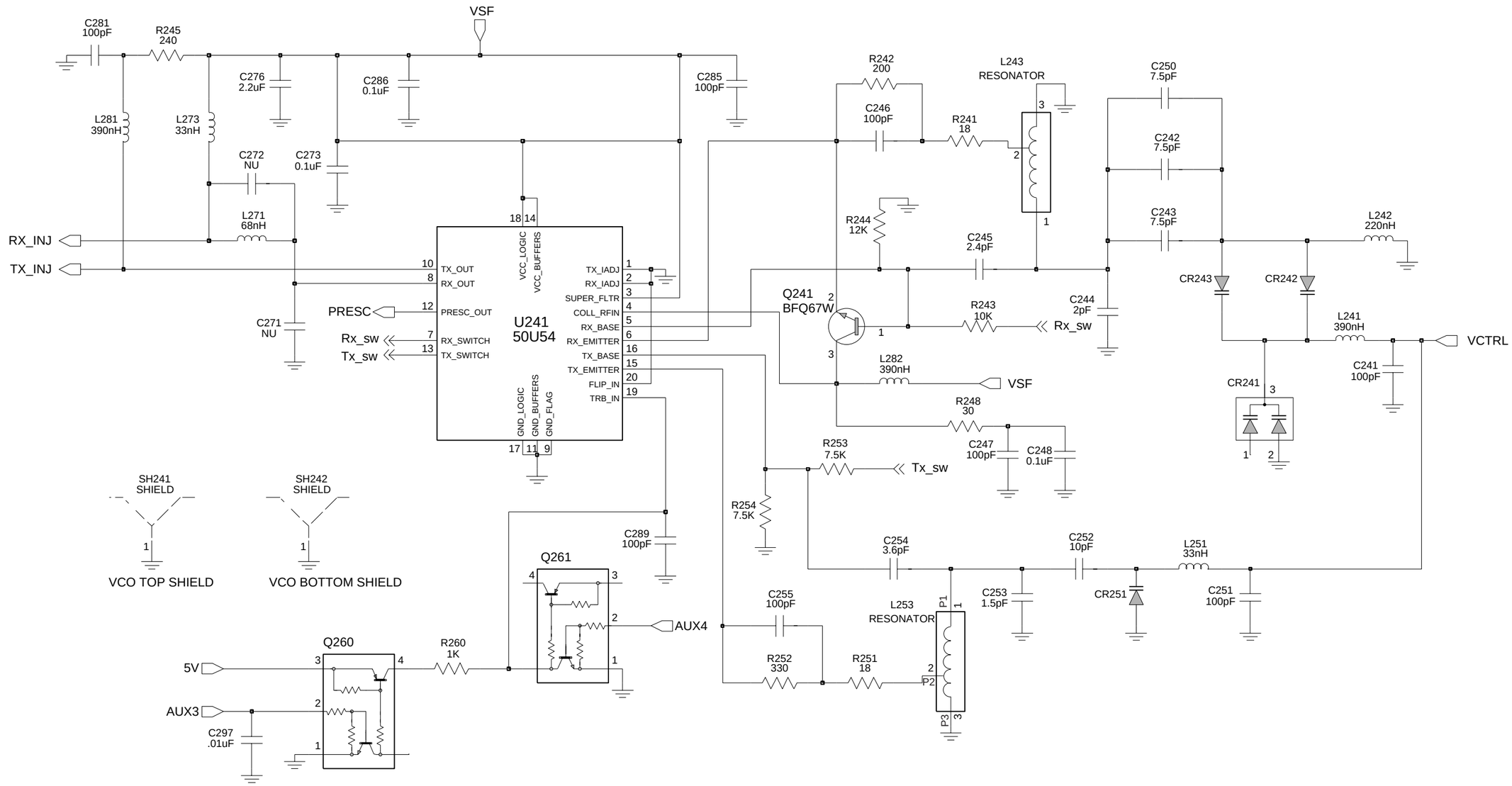

Figure 7-7: UHF Voltage Controlled Oscillator Schematic Diagram

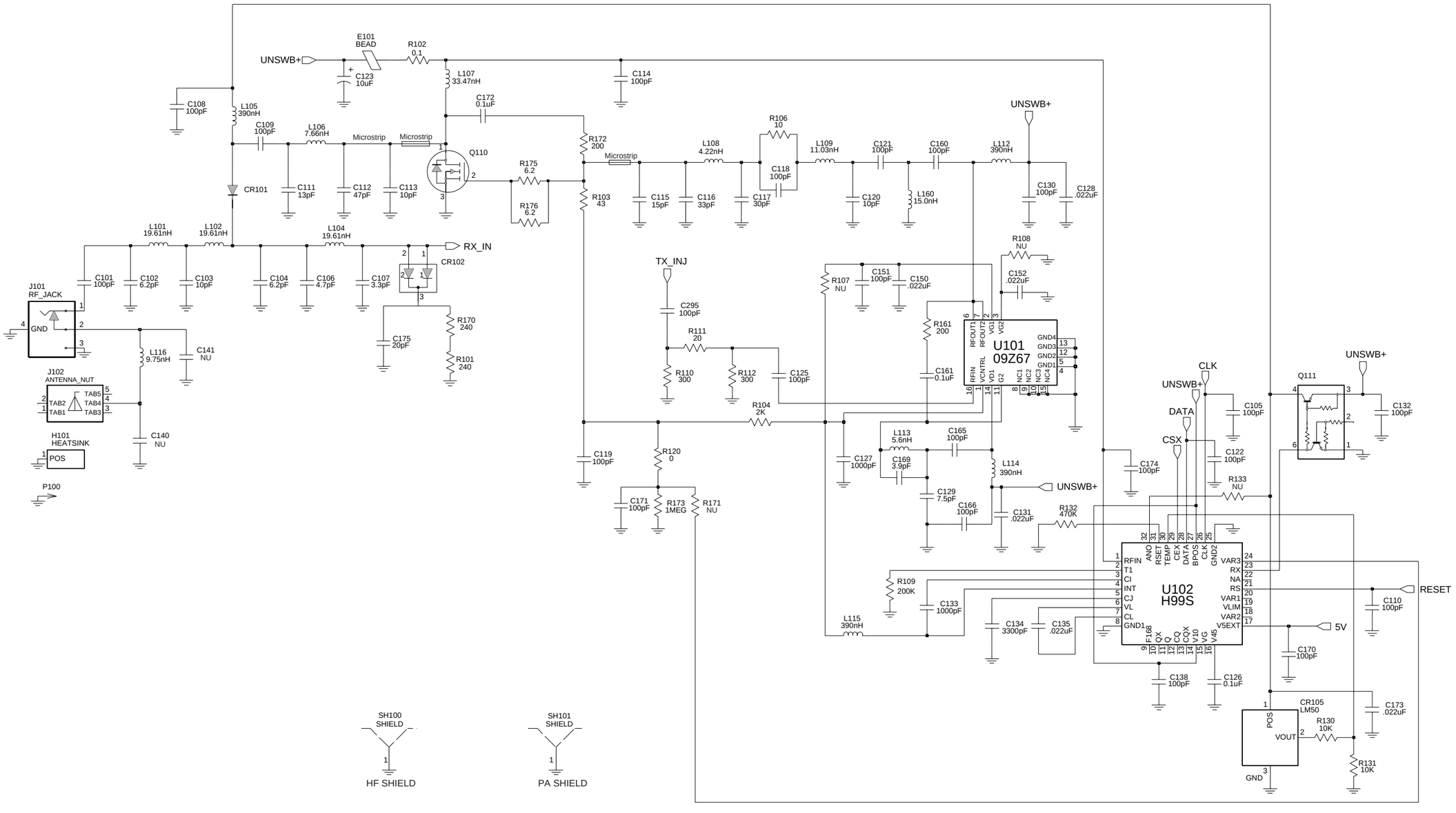

Figure 7-8: UHF Transmitter Schematic Diagram

UHF Band 1 Radio Parts List

Circuit Ref	Motorola Part No.	Description
B501	0986237A02	Battery Contact Module
B503	3980502Z01	Backup Battery Contact, B+ (not used in GP328 Plus)
B504	3980501Z01	Backup Battery Contact, B- (not used in GP328 Plus)
C101	2113740F51	100
C102	2113740F22	6.2
C103	2113740F27	10
C104	2113740F22	6.2
C105	2113743N50	100pF
C106	2113740F19	4.7pF
C107	2113740F15	3.3
C108	2113743N50	100pF
C109	2113740F51	100
C110	2113743N50	100pF
C111	2113740F30	13
C112	2180605Z32	47pF
C113	2180605Z16	10pF
C114	2113743N50	100pF
C115	2113743N32	18pF
C116	2113743N38	33.0pF
C117	2113743N34	22pF
C118	2113743N50	100pF
C119	2113743N50	100pF
C120	2113743N27	11pF
C121	2113743N50	100pF
C122	2113743N50	100pF
C123	2311049A18	10UF
C125	2113743N50	100pF
C126	2113743M24	0.1UF,+80%/-20%
C127	2113743L17	1000pF,10%
C128	2113743M08	22000pF
C129	2113743N23	7.5pF
C130	2113743N50	100pF
C131	2113743M08	22000pF
C132	2113743N50	100pF
C133	2113743L17	1000pF,10%
C134	2113743L29	3300pF
C135	2113743M08	22000pF
C138	2113743N50	100pF
C150	2113743M08	22000pF
C151	2113743N50	100pF
C152	2113743M08	22000pF
C160	2113743N50	100pF
C161	2113743M24	0.1UF,+80%/-20%
C165	2113743N50	100pF
C166	2113743N50	100pF
C169	2113743N20	5.6pF
C170	2113743N50	100pF
C171	2113743N50	100pF
C172	2113743E20	10UF
C173	2113743M08	22000pF
C174	2113743N50	100pF
C175	2113740F51	100pF
C201	2113743N50	100pF
C202	2113743L17	1000pF,10%
C203	2311049A56	4.7UF
C204	2104993J02	2.2UF
C206	2113740F63	330
C207	2113743N40	39.0pF
C208	2113743N08	1.6pF
C210	2113743N50	100pF
C211	2113743N50	100pF
C212	2113743N50	100pF
C213	2113743N50	100pF
C214	2113743N50	100pF
C217	2104993J02	2.2UF
C218	2113743M24	0.1UF,+80%/-20%
C219	2113743K16	0.220UF,+80%/-20%
C220	2113743N50	100pF
C223	2113743M24	0.1UF,+80%/-20%
C224	2113743M24	0.1UF,+80%/-20%
C228	2311049J11	4.7UF
C229	2113743L17	1000pF,10%
C230	2113743N50	100pF
C231	2113743M24	0.1UF,+80%/-20%
C232	2113743E12	0.047UF
C233	2311049A01	0.1UF
C234	2311049A05	0.47UF
C235	2104993J02	2.2UF
C238	2113741F17	470
C241	2113743N50	100pF
C242	2113743N23	7.5pF
C243	2113743N23	7.5pF
C244	2113740F10	2
C245	2113743N11	2.4pF
C246	2113743N50	100pF
C247	2113743N50	100pF
C248	2113743M24	0.1UF,+80%/-20%
C250	2113743N23	7.5pF
C251	2113743N50	100pF
C252	2113743N26	10.0pF
C253	2113740F09	1.8
C254	2113743N15	3.6pF
C255	2113743N50	100pF
C257	2113743N50	100pF
C258	2113743L41	1000pF
C259	2113743L41	1000pF
C260	2113743N50	100pF
C263	2113743N02	0.75pF
C264	2113743N50	100pF
C273	2113743M24	0.1UF,+80%/-20%
C276	2104993J02	2.2UF
C277	2113743N50	100pF
C278	2311049A09	2.2UF
C279	2104993J02	2.2UF
C281	2113743N50	100pF
C285	2113743N50	100pF
C286	2113743M24	0.1UF,+80%/-20%
C289	2113743N50	100pF
C291	2311049A69	10.0UF
C292	2113743M24	0.1UF,+80%/-20%
C293	2113743A27	0.470UF
C294	2113743N50	100pF
C295	2113743N50	100pF
C296	2113743M24	0.1UF,+80%/-20%
C297	2113743L41	1000pF
C298	2113743M24	0.1UF,+80%/-20%
C301	2113743N15	3.6pF
C302	2113743N26	10.0pF
C303	2113740L08	3.9pF
C304	2113743N26	10.0pF
C305	2113743N33	20.0pF
C307	2113743M24	0.1UF,+80%/-20%
C308	2113743N50	100pF
C309	2113743N50	100pF
C310	2113743M24	0.1UF,+80%/-20%
C312	2113743N25	9.1pF
C313	2113743N26	10.0pF
C314	2113743M24	0.1UF,+80%/-20%
C315	2113743N50	100pF
C316	2113740L08	1200pF
C317	2113743N25	9.1pF
C318	2113743N23	7.5pF
C319	2113743N69	1.8pF
C320	2113743N23	7.5pF
C321	2113743N50	100pF
C322	2113743N48	82.0pF
C323	2113743N54	150pF
C324	2113743N33	20.0pF
C325	2113743L41	1000pF
C326	2113743L41	1000pF
C327	2113743N50	100pF
C328	2113743M24	0.1UF,+80%/-20%
C329	2113743M24	0.1UF,+80%/-20%
C330	2113743N26	10.0pF
C331	2113743N50	100pF
C334	2113743M08	22000pF
C336	2113743M24	0.1UF,+80%/-20%
C337	2113743N50	100pF
C338	2113743N30	15.0pF
C339	2180478Z20	1.0UF
C340	2180478Z20	1.0UF
C341	2180478Z20	1.0UF
C342	2180478Z20	1.0UF
C343	2113743A23	0 .220UF ,10%
C344	2113743M24	0.1UF,+80%/-20%
C345	2113743M24	0.1UF,+80%/-20%
C346	2113743M24	0.1UF,+80%/-20%
C347	2113743M24	0.1UF,+80%/-20%
C348	2113743M24	0.1UF,+80%/-20%
C349	2113743E07	0.022UF,10%
C350	2113743L05	330pF,10%
C351	2113743N33	20.0pF
C352	2113743N28	12.0pF
C353	2113743N41	43.0pF
C354	2113743N42	47.0pF
C355	2113743A24	0.330UF
C356	2113743M08	22000pF
C357	2113743A23	0 .220UF ,10%
C358	2113741A23	1200pF
C359	2109720D14	0.1UF
C360	2113743E07	0.022UF,10%
C361	2113741F49	10NF
C362	2113743M08	22000pF
C363	2311049A40	2.2UF
C364	2113743L41	1000pF
C370	2113743N50	100pF
C374	2113743N50	100pF
C375	2113743N50	100pF
C380	2113743L41	1000pF
C381	2113743N21	6.2pF
C382	2311049A59	10UF
C383	2113743N50	100pF
C384	2113743N44	56.0pF
C385	2113743N44	56.0pF
C386	2113743N50	100pF
C390	2113743N50	100pF
C395	2113743N50	100pF
C397	2311049A05	0.47UF
CR101	4880973Z02	PIN DIODE
CR102	4802245J41	PIN DIODE
CR105	5185963A15	Temperature Sense
CR201	4802233J09	Triple Diode
CR203	4862824C03	Varactor
CR241	4805649Q13	DUAL Varactor
CR242	4862824C01	Varactor
CR243	4862824C01	Varactor
CR251	4802245J22	Varactor
CR301	4862824C01	Varactor
CR302	4862824C01	Varactor

Circuit Ref	Motorola Part No.	Description
CR303	4880154K03	DUAL COMMON ANODE-CATHODE
CR304	4862824C01	Varactor
CR305	4862824C01	Varactor
CR306	4802245J42	RING QUAD DIODE
CR308	4802245J41	PIN DIODE
CR310	4862824C01	Varactor
CR501	4880107R01	Rectifier
CR503	4805729G49	LED RED/YEL
E101	2484657R01	Ferrite Bead
F501	6580542Z01	FUSE 3A
FL201	4805875Z04	16.8MHZ XTAL (Clip)
FL301	4802245J43	Xtal Filter 45.1 MHZ
H101	2680499Z01	Heat Spreader
J101	0985613Z01	RF Jack
J102	0280519Z02	Antenna Nut
J200	0905505Y04	40-Pins Connector
L101	2479990B02	19.61NH,10%
L102	2479990B02	19.61NH,10%
L104	2479990B02	19.61NH,10%
L105	2462587N22	390 NH ,10%
L106	2479990A02	7.66NH,10%
L107	2479990G01	33.47NH
L108	2479990A01	4.22NH,10%
L109	2479990B01	11.03NH
L112	2462587N45	22 NH ,5%
L113	2413926H09	5.6NH
L114	2462587N45	22 NH ,5%
L115	2462587N22	393 NH ,10%
L116	2479990A03	9.75NH,10%
L160	2413926H14	15.0 NH
L201	2462587Q20	2.2uH,20%
L202	2462587Q20	2.2uH,20%
L203	2462587Q20	2.2uH,20%
L232	2462587P25	12000 NH
L241	2462587V41	390NH,10%
L242	2462587V38	220NH,5%
L243	2460593C01	Teflon Resonator
L251	2462587V28	33NH,5%
L253	2460593C02	Teflon Resonator
L261	2462587V29	39NH,5%
L271	2462587V32	68NH
L273	2462587V28	33NH,5%
L281	2462587V41	390NH,10%
L282	2462587V41	390NH,10%
L301	2479990C01	13.9NH,10%
L302	2479990C01	13.9NH,10%
L303	2462587V26	22NH
L304	2462587V37	180NH,5%
L305	2462587V26	22NH
L306	2479990C01	13.9NH,10%

Circuit Ref	Motorola Part No.	Description
L307	2479990C01	13.9NH,10%
L309	2479990C02	16.28NH
L310	2462587V36	150NH,5%
L311	2462587N65	750NH,5%
L314	2462587N72	2.2uH,5%
L325	2480646Z20	2.20UH
L330	2462587N64	680NH,5%
L331	2480646Z20	2.20UH
L332	2462587N53	100NH,5%
L340	2462587V41	390NH,10%
L400	2462587Q42	390NH 10%
L401	2462587Q42	390NH 10%
L410	2462587Q42	390NH 10%
L411	2462587Q42	390NH 10%
L505	2462587Q42	390NH,10%
P100	3905643V01	Gnd Contact Finger
PB501	4070354A01	Tact Switch
PB502	4070354A01	Tact Switch
PB504	4070354A01	Tact Switch
PB505	4070354A01	Tact Switch
Q110	4813828A09	RF Power FET
Q111	4802245J50	DUAL NPN
Q210	4802245J50	DUAL NPN
Q241	4805218N63	NPN Transistor
Q260	4802245J50	DUAL NPN
Q261	4802245J50	DUAL NPN
Q301	4802245J44	Npn
Q302	4802245J44	Npn
Q315	4880214G02	NPN
Q320	4805218N63	NPN Transistor
Q502	5180159R01	Dual NPN
Q505	4880214G02	NPN
R101	0662057A34	240
R102	0680735Z01	0.075
R103	0662057M41	43
R104	0662057N15	47K
R106	0662057M26	10
R108	0662057M92	5.6K
R109	0662057N30	200K
R110	0662057M61	300
R111	0662057M33	20
R112	0662057M61	300
R120	0662057N14	43K
R130	0662057M98	10K
R131	0662057N05	18K
R132	0662057N33	270K
R161	0662057M57	200
R170	0662057A34	240
R171	0662057N14	43K
R172	0662057A32	200
R173	0662057N29	180K

Circuit Ref	Motorola Part No.	Description
R175	0662057B59	3.0 ohm
R176	0662057B59	3.0 ohm
R201	0662057N21	82K
R202	0662057N23	100K
R204	0662057N15	47K
R231	0662057M52	120
R232	0662057M69	620
R233	0662057M68	560
R241	0662057M32	18
R242	0662057M57	200
R243	0662057M98	10K
R244	0662057N01	12K
R245	0662057M59	240
R248	0662057M37	30
R251	0662057M32	18
R252	0662057M62	330
R253	0662057M95	7.5K
R254	0662057M95	7.5K
R255	0662057M89	4.3K
R256	0662057M37	30
R260	0662057M74	1K
R300	0662057M82	2.2K
R301	0662057N23	100K
R302	0662057N23	100K
R303	0662057M74	1K
R304	0662057N01	12K
R305	0662057M67	510
R306	0662057N23	100K
R307	0662057N23	100K
R308	0662057M60	270
R309	0662057M32	18
R310	0662057M60	270
R311	0662057N10	30K
R312	0662057M83	2.4K
R313	0662057M62	330
R314	0662057M85	3K
R315	0662057N01	12K
R316	0662057A96	91K
R317	0662057M74	1K
R318	0662057A79	18K
R319	0662057A29	150
R320	0662057M74	1K
R321	0662057M83	2.4K
R322	0662057N30	200K
R324	0662057M81	2K
R325	0662057M94	6.8K
R327	0662057N11	33K
R328	0662057M12	2.7
R329	0662057M01	0
R339	0662057M01	0
R340	0662057M94	6.8K

Circuit Ref	Motorola Part No.	Description
R342	0662057N23	100K
R343	0662057M26	10
R344	0662057N01	12K
R345	0662057M98	10K
R346	0662057N17	56K
R347	0662057M74	1K
R348	0662057M87	3.6K
R349	0662057C01	0
R350	0662057N23	100K
R351	0662057C01	0
R352	0662057M86	3.3K
R355	0662057M01	0
R509	0662057M01	0
RT300	0680590Z01	33K
RT400	0680590Z01	Thermistor 33K
S501	4080710Z01	Channel Switch
S502	1880619Z02	Volume Switch
SH100	2680507Z01	Harmonic Filter Shield
SH101	2680510Z01	PA Shield
SH201	2680511Z01	Synthersizer Top Shield
SH202	2680511Z01	Synthersizer Bottom Shield
SH241	2604120G01	Vco Top Shield
SH242	2680514Z01	Vco Bottom Shield
SH301	2680554Z01	Rx Pre-Filter Shield
SH302	2680555Z01	Rx Post-Filter/RF Amp Shield
SH303	2680509Z01	Mixer Shield
SH304	2680624Z01	Mixer Diode Shield
SH321	2680508Z01	ZIF 2nd LO Shield
SH322	2680514Z01	ZIF Shield
SH323	2604082P01	Xtal Filter Shield
T301	2580541Z02	Xfmr Coil
T302	2580541Z02	Xfmr Coil
U101	5185130C65	LDMOS DRIVER
U102	5185765B28	Power Control IC
U201	5185963A27	LVFRACN
U210	5102463J61	INVERTER
U211	5102463J61	INVERTER
U241	5105750U54	VCO BUFFER
U247	5105739X05	REGULATOR LINEAR
U248	5102463J58	3.3V REG
U301	5109632D83	LVZIF
B501	0986237A02	Battery Contact Module
B503	3980502Z01	Backup Battery Contact, B+ (not used in GP328 Plus)
B504	3980501Z01	Backup Battery Contact, B- (not used in GP328 Plus)
C101	2113740F51	100
C102	2113740F22	6.2
C103	2113740F27	10
C104	2113740F22	6.2
C105	2113743N50	100pF

Circuit Ref	Motorola Part No.	Description
C106	2113740F19	4.7pF
C107	2113740F15	3.3
C108	2113743N50	100pF
C109	2113740F51	100
C110	2113743N50	100pF
C111	2113740F30	13
C112	2180605Z32	47pF
C113	2180605Z16	10pF
C114	2113743N50	100pF
C115	2113743N32	18pF
C116	2113743N38	33.0pF
C117	2113743N34	22pF
C118	2113743N50	100pF
C119	2113743N50	100pF
C120	2113743N27	11pF
C121	2113743N50	100pF
C122	2113743N50	100pF
C123	2311049A18	10UF
C125	2113743N50	100pF
C126	2113743M24	0.1UF,+80%/-20%
C127	2113743L17	1000pF,10%
C128	2113743M08	22000pF
C129	2113743N23	7.5pF
C130	2113743N50	100pF
C131	2113743M08	22000pF
C132	2113743N50	100pF
C133	2113743L17	1000pF,10%
C134	2113743L29	3300pF
C135	2113743M08	22000pF
C138	2113743N50	100pF
C150	2113743M08	22000pF
C151	2113743N50	100pF
C152	2113743M08	22000pF
C160	2113743N50	100pF
C161	2113743M24	0.1UF,+80%/-20%
C165	2113743N50	100pF
C166	2113743N50	100pF
C169	2113743N20	5.6pF
C170	2113743N50	100pF
C171	2113743N50	100pF
C172	2113743E20	10UF
C173	2113743M08	22000pF
C174	2113743N50	100pF
C175	2113740F51	100pF
C201	2113743N50	100pF
C202	2113743L17	1000pF,10%
C203	2311049A56	4.7UF
C204	2104993J02	2.2UF
C206	2113740F63	330
C207	2113743N40	39.0pF
C208	2113743N08	1.6pF

Circuit Ref	Motorola Part No.	Description
C210	2113743N50	100pF
C211	2113743N50	100pF
C212	2113743N50	100pF
C213	2113743N50	100pF
C214	2113743N50	100pF
C217	2104993J02	2.2UF
C218	2113743M24	0.1UF,+80%/-20%
C219	2113743K16	0.220UF,+80%/-20%
C220	2113743N50	100pF
C223	2113743M24	0.1UF,+80%/-20%
C224	2113743M24	0.1UF,+80%/-20%
C228	2311049J11	4.7UF
C229	2113743L17	1000pF,10%
C230	2113743N50	100pF
C231	2113743M24	0.1UF,+80%/-20%
C232	2113743E12	0.047UF
C233	2311049A01	0.1UF
C234	2311049A05	0.47UF
C235	2104993J02	2.2UF
C238	2113741F17	470
C241	2113743N50	100pF
C242	2113743N23	7.5pF
C243	2113743N23	7.5pF
C244	2113740F10	2
C245	2113743N11	2.4pF
C246	2113743N50	100pF
C247	2113743N50	100pF
C248	2113743M24	0.1UF,+80%/-20%
C250	2113743N23	7.5pF
C251	2113743N50	100pF
C252	2113743N26	10.0pF
C253	2113740F09	1.8
C254	2113743N15	3.6pF
C255	2113743N50	100pF
C257	2113743N50	100pF
C258	2113743L41	1000pF
C259	2113743L41	1000pF
C260	2113743N50	100pF
C263	2113743N02	0.75pF
C264	2113743N50	100pF
C273	2113743M24	0.1UF,+80%/-20%
C276	2104993J02	2.2UF
C277	2113743N50	100pF
C278	2311049A09	2.2UF
C279	2104993J02	2.2UF
C281	2113743N50	100pF
C285	2113743N50	100pF
C286	2113743M24	0.1UF,+80%/-20%
C289	2113743N50	100pF
C291	2311049A69	10.0UF
C292	2113743M24	0.1UF,+80%/-20%

Circuit Ref	Motorola Part No.	Description
C293	2113743A27	0.470UF
C294	2113743N50	100pF
C295	2113743N50	100pF
C296	2113743M24	0.1UF,+80%/-20%
C297	2113743L41	1000pF
C298	2113743M24	0.1UF,+80%/-20%
C301	2113743N15	3.6pF
C302	2113743N26	10.0pF
C303	2113740L08	3.9pF
C304	2113743N26	10.0pF
C305	2113743N33	20.0pF
C307	2113743M24	0.1UF,+80%/-20%
C308	2113743N50	100pF
C309	2113743N50	100pF
C310	2113743M24	0.1UF,+80%/-20%
C312	2113743N25	9.1pF
C313	2113743N26	10.0pF
C314	2113743M24	0.1UF,+80%/-20%
C315	2113743N50	100pF
C316	2113740L08	1200pF
C317	2113743N25	9.1pF
C318	2113743N23	7.5pF
C319	2113743N69	1.8pF
C320	2113743N23	7.5pF
C321	2113743N50	100pF
C322	2113743N48	82.0pF
C323	2113743N54	150pF
C324	2113743N33	20.0pF
C325	2113743L41	1000pF
C326	2113743L41	1000pF
C327	2113743N50	100pF
C328	2113743M24	0.1UF,+80%/-20%
C329	2113743M24	0.1UF,+80%/-20%
C330	2113743N26	10.0pF
C331	2113743N50	100pF
C334	2113743M08	22000pF
C336	2113743M24	0.1UF,+80%/-20%
C337	2113743N50	100pF
C338	2113743N30	15.0pF
C339	2180478Z20	1.0UF
C340	2180478Z20	1.0UF
C341	2180478Z20	1.0UF
C342	2180478Z20	1.0UF
C343	2113743A23	0 .220UF ,10%
C344	2113743M24	0.1UF,+80%/-20%
C345	2113743M24	0.1UF,+80%/-20%
C346	2113743M24	0.1UF,+80%/-20%
C347	2113743M24	0.1UF,+80%/-20%
C348	2113743M24	0.1UF,+80%/-20%
C349	2113743E07	0.022UF,10%
C350	2113743L05	330pF,10%

Circuit Ref	Motorola Part No.	Description
C351	2113743N33	20.0pF
C352	2113743N28	12.0pF
C353	2113743N41	43.0pF
C354	2113743N42	47.0pF
C355	2113743A24	0.330UF
C356	2113743M08	22000pF
C357	2113743A23	0 .220UF ,10%
C358	2113741A23	1200pF
C359	2109720D14	0.1UF
C360	2113743E07	0.022UF,10%
C361	2113741F49	10NF
C362	2113743M08	22000pF
C363	2311049A40	2.2UF
C364	2113743L41	1000pF
C370	2113743N50	100pF
C374	2113743N50	100pF
C375	2113743N50	100pF
C380	2113743L41	1000pF
C381	2113743N21	6.2pF
C382	2311049A59	10UF
C383	2113743N50	100pF
C384	2113743N44	56.0pF
C385	2113743N44	56.0pF
C386	2113743N50	100pF
C390	2113743N50	100pF
C395	2113743N50	100pF
C397	2311049A05	0.47UF
CR101	4880973Z02	PIN DIODE
CR102	4802245J41	PIN DIODE
CR105	5185963A15	Temperature Sense
CR201	4802233J09	Triple Diode
CR203	4862824C03	Varactor
CR241	4805649Q13	DUAL Varactor
CR242	4862824C01	Varactor
CR243	4862824C01	Varactor
CR251	4802245J22	Varactor

* Motorola Depot Servicing only

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8.1 UHF Band 2, Circuit Board/Schematic Diagrams and Parts List

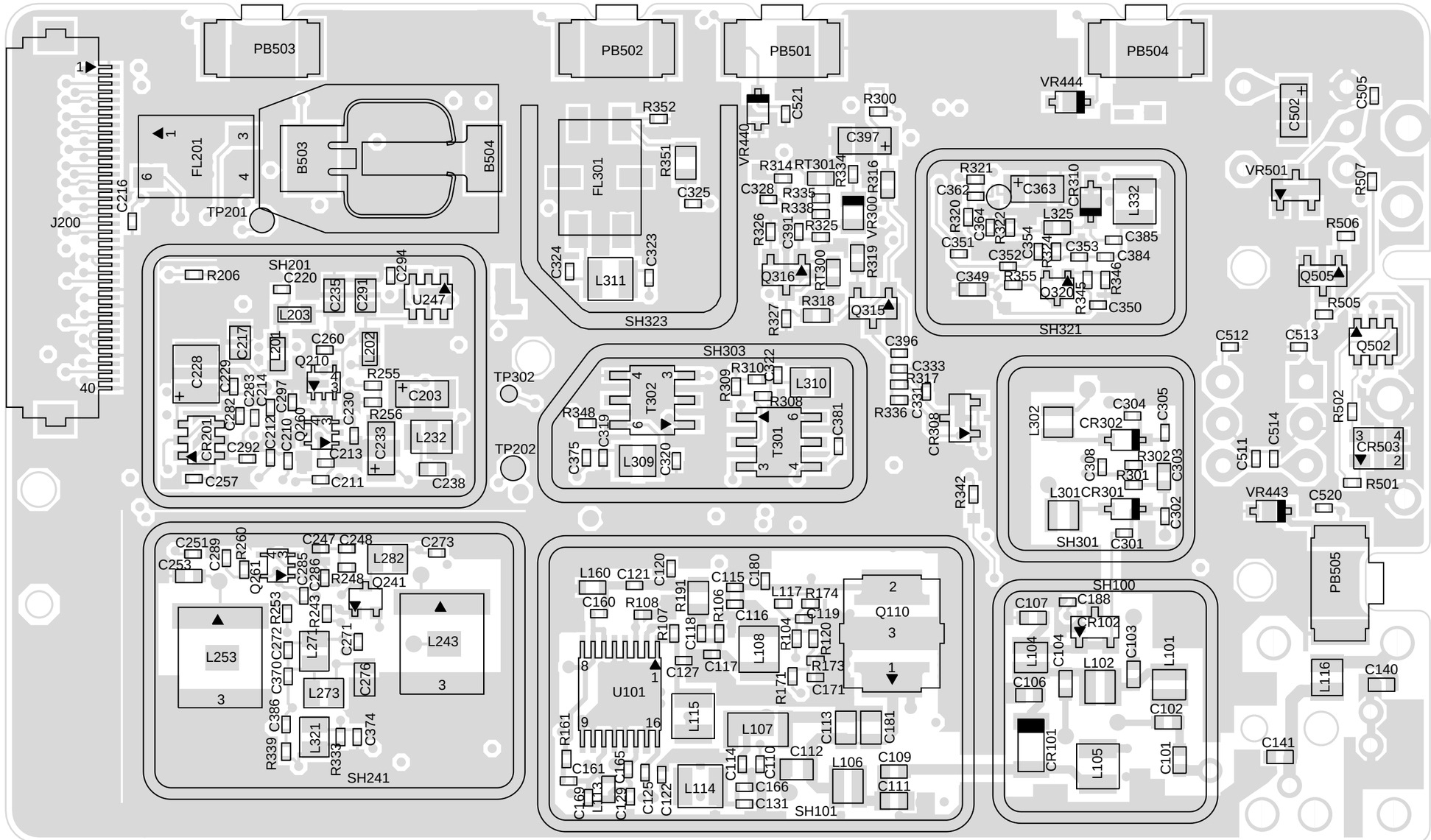


Figure 8-1: UHF Band 2 (450-527MHz) Main Board Top Side PCB No. 8485641Z02

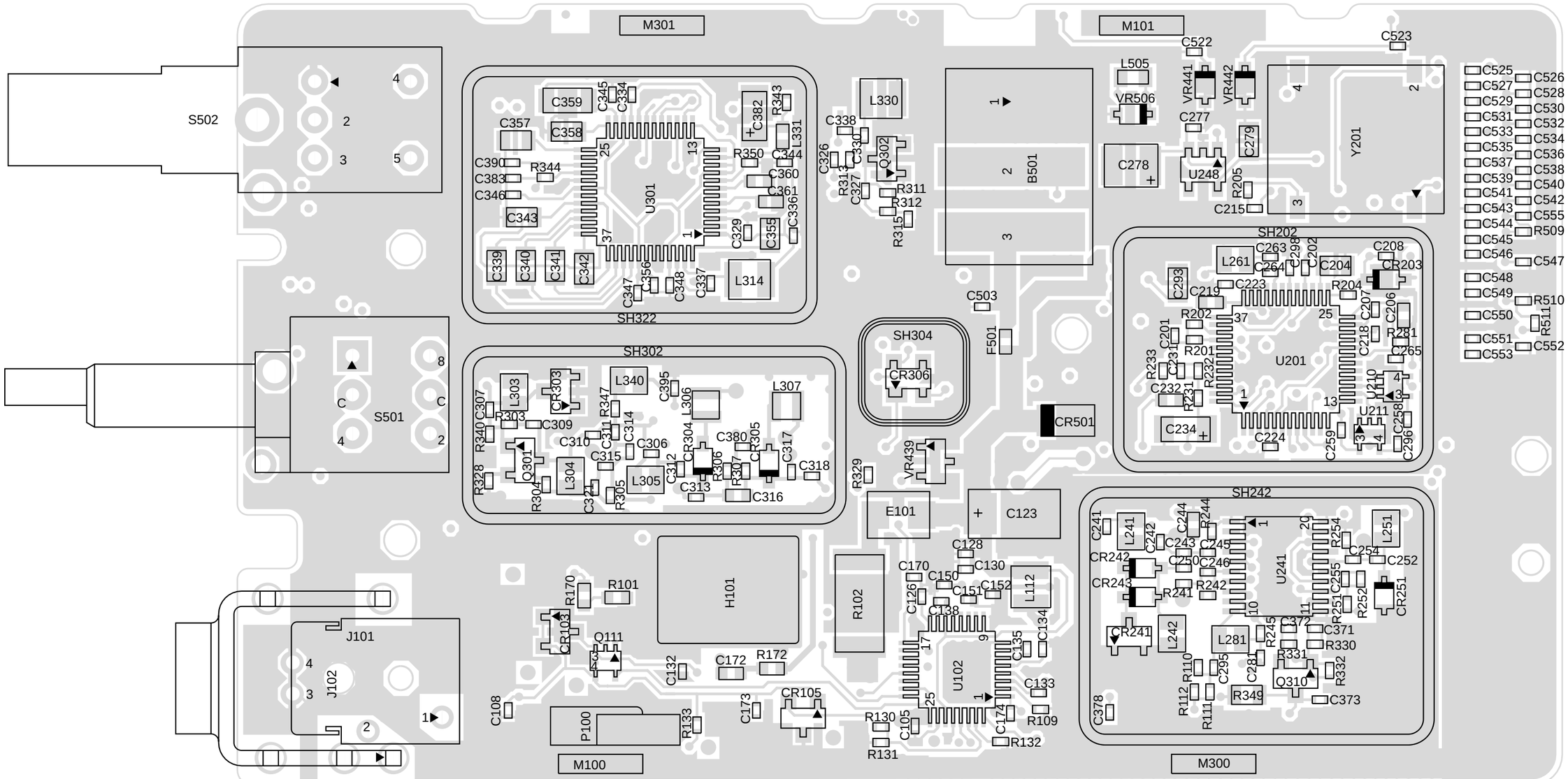


Figure 8-2: UHF Band 2 (450-527MHz) Main Board Bottom Side PCB No. 8485641Z02

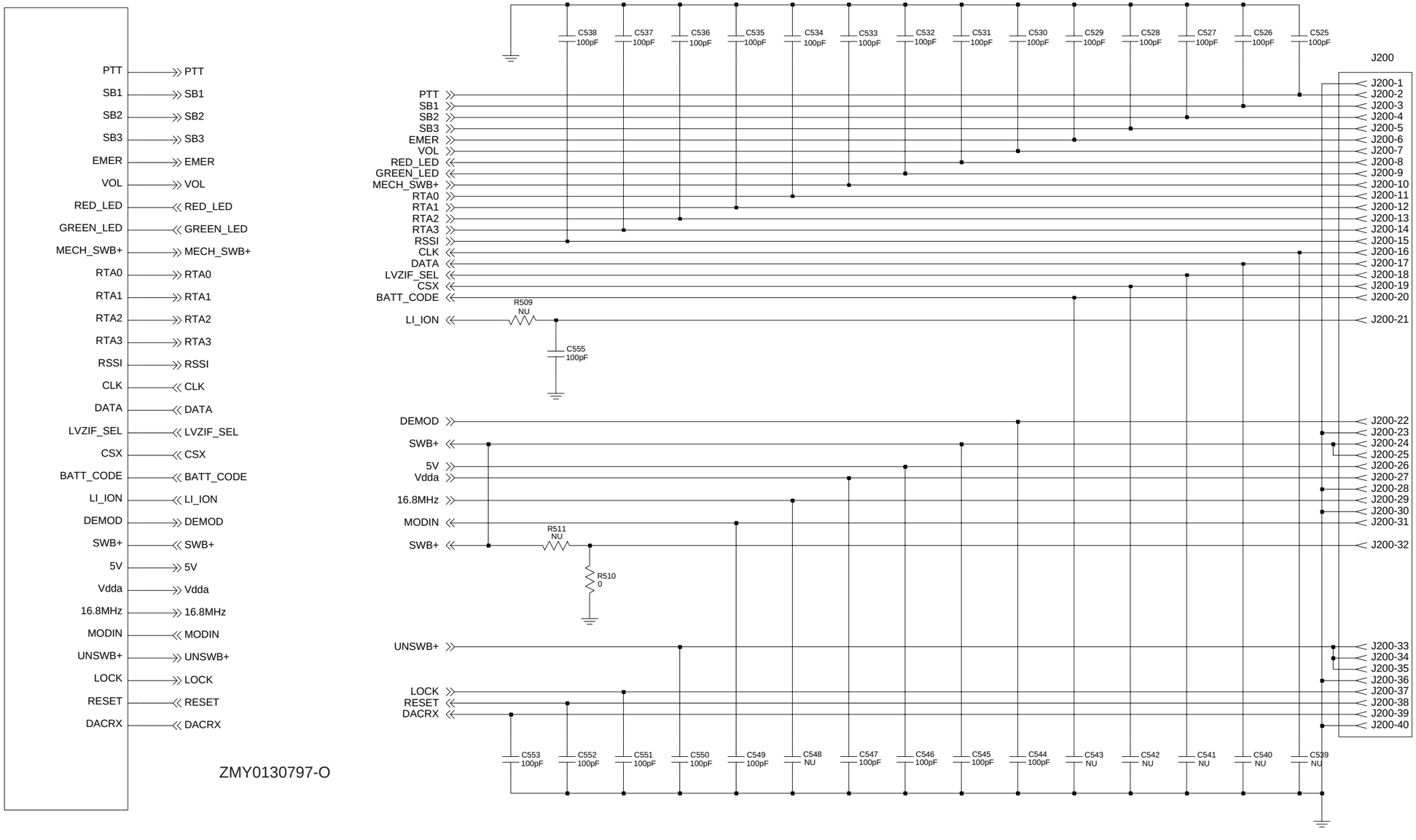


Figure 8-3: UHF Band 2 Controls And Switches Schematic Diagram

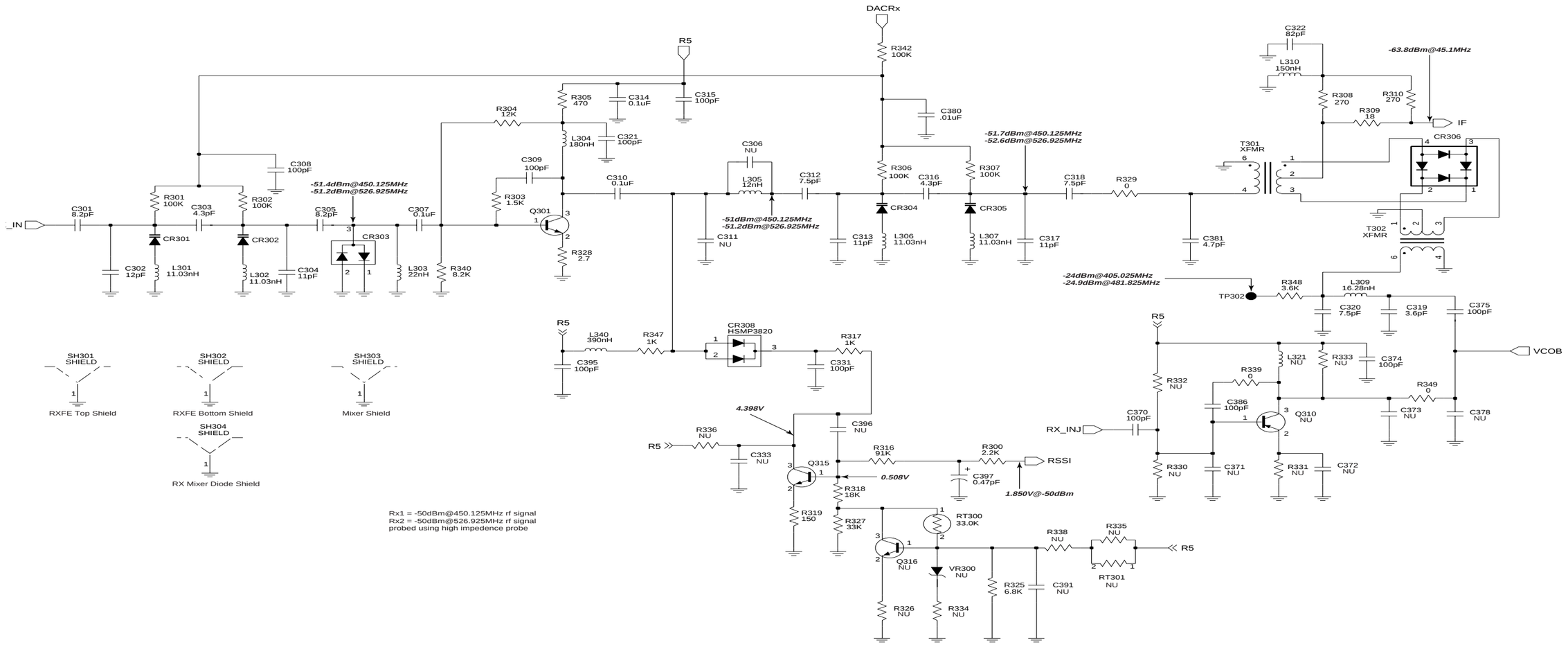


Figure 8-4: UHF Band 2 Receiver Front End Schematic Diagram

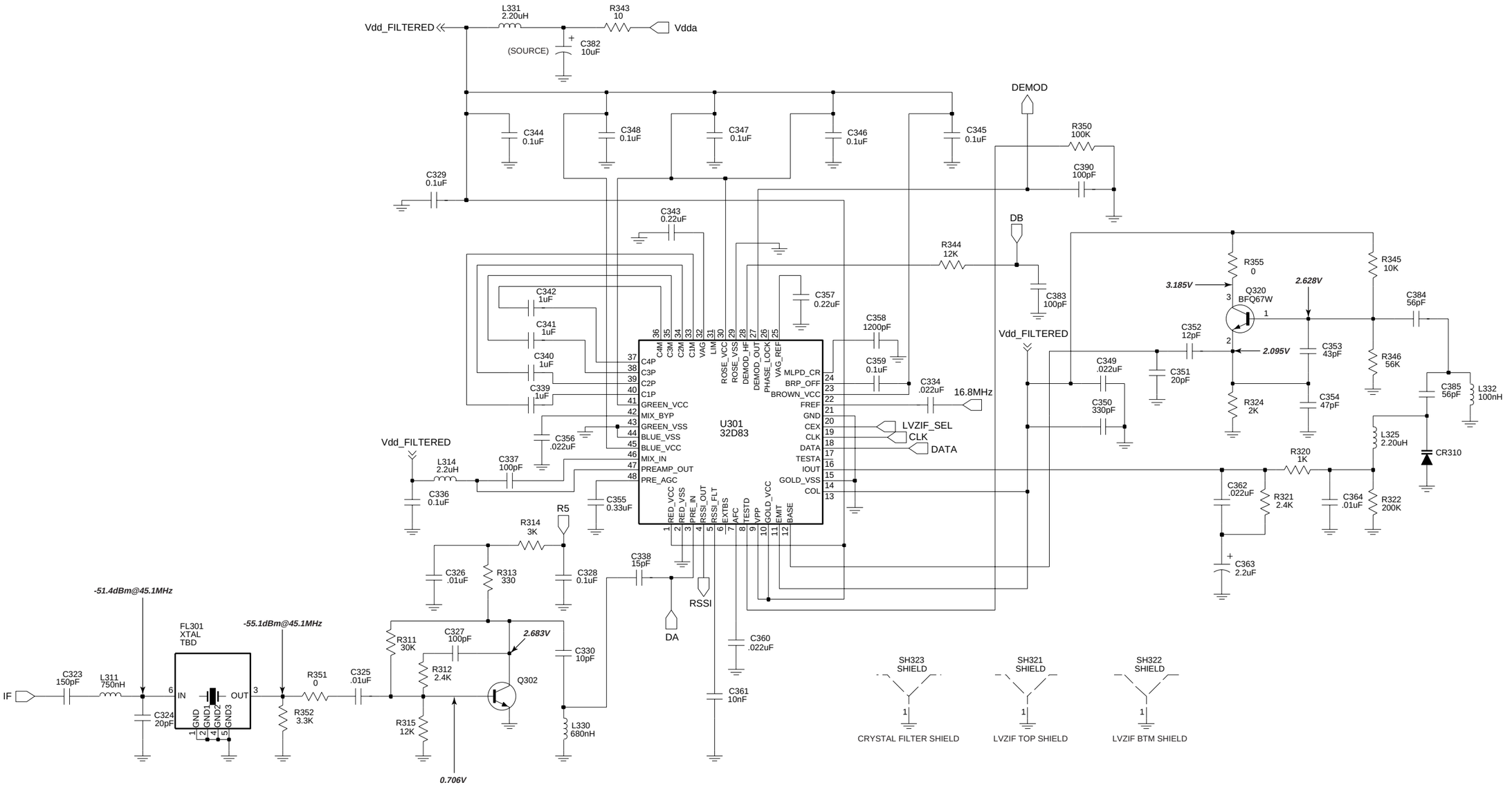
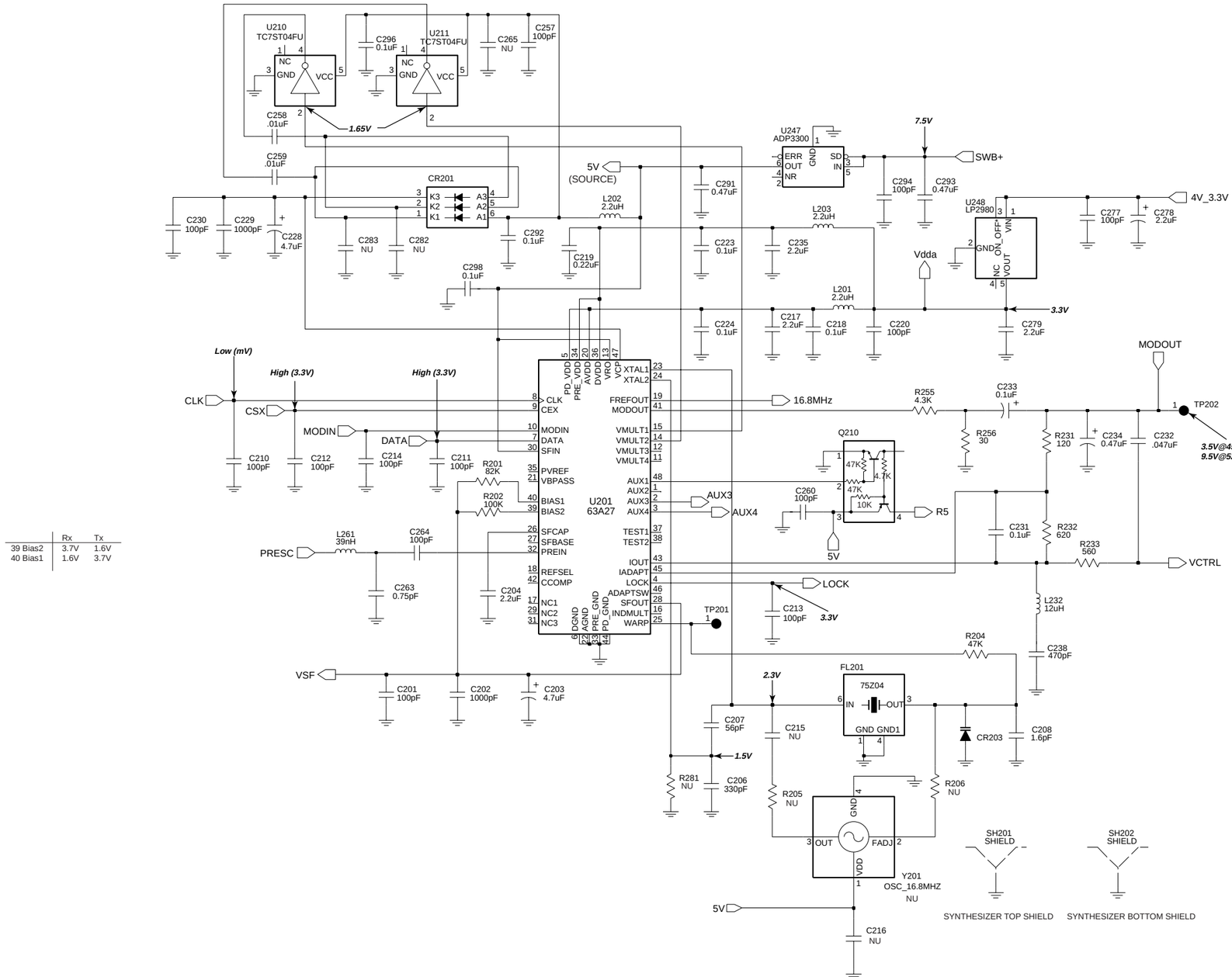


Figure 8-5: UHF Band 2 Receiver Back End Schematic Diagram



	Rx	Tx
39 Bias2	3.7V	1.6V
40 Bias1	1.6V	3.7V

Figure 8-6: UHF Band 2 Synthesizer Schematic Diagram

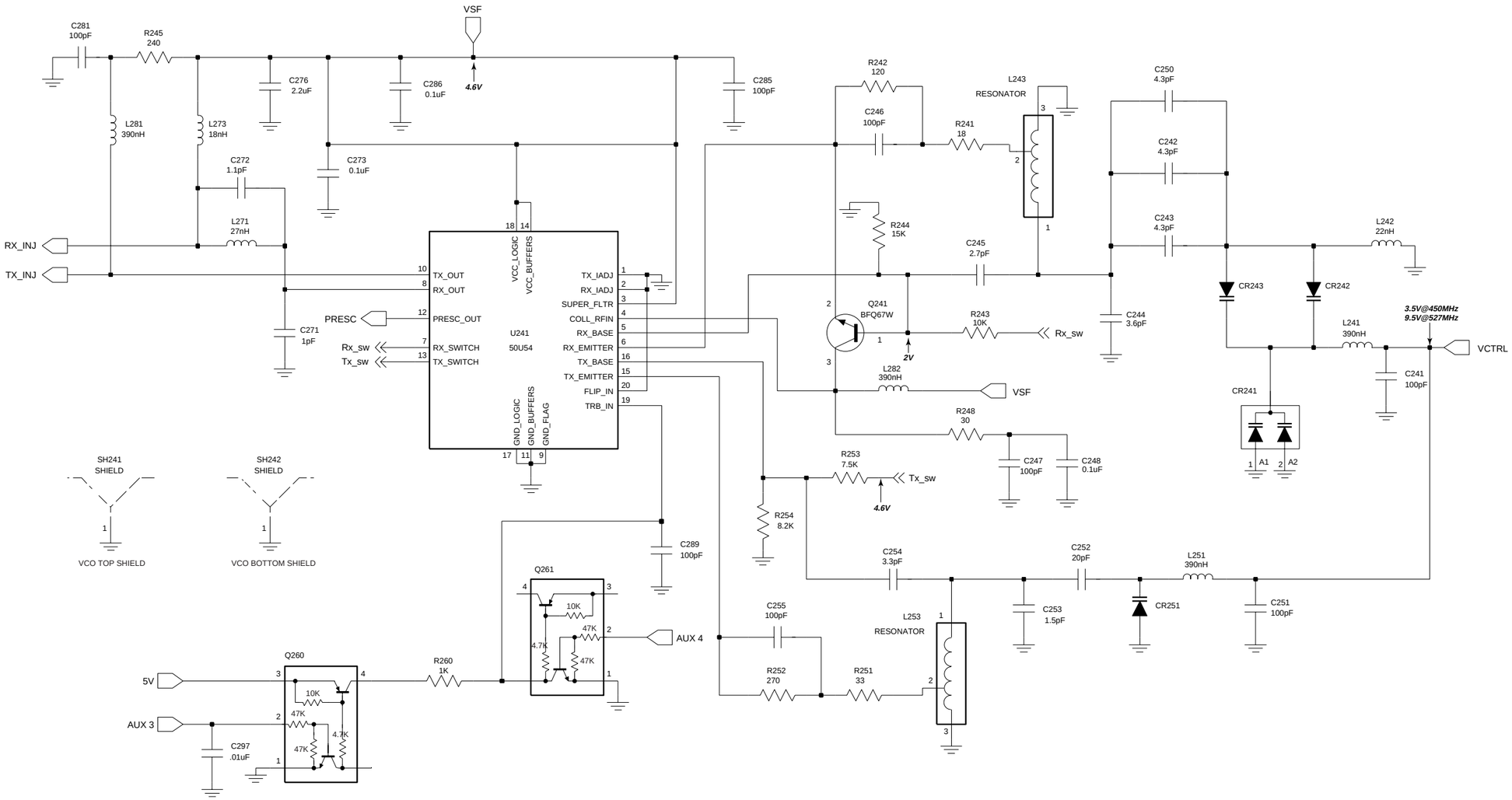


Figure 8-7: UHF Band 2 Voltage Controlled Oscillator Schematic Diagram

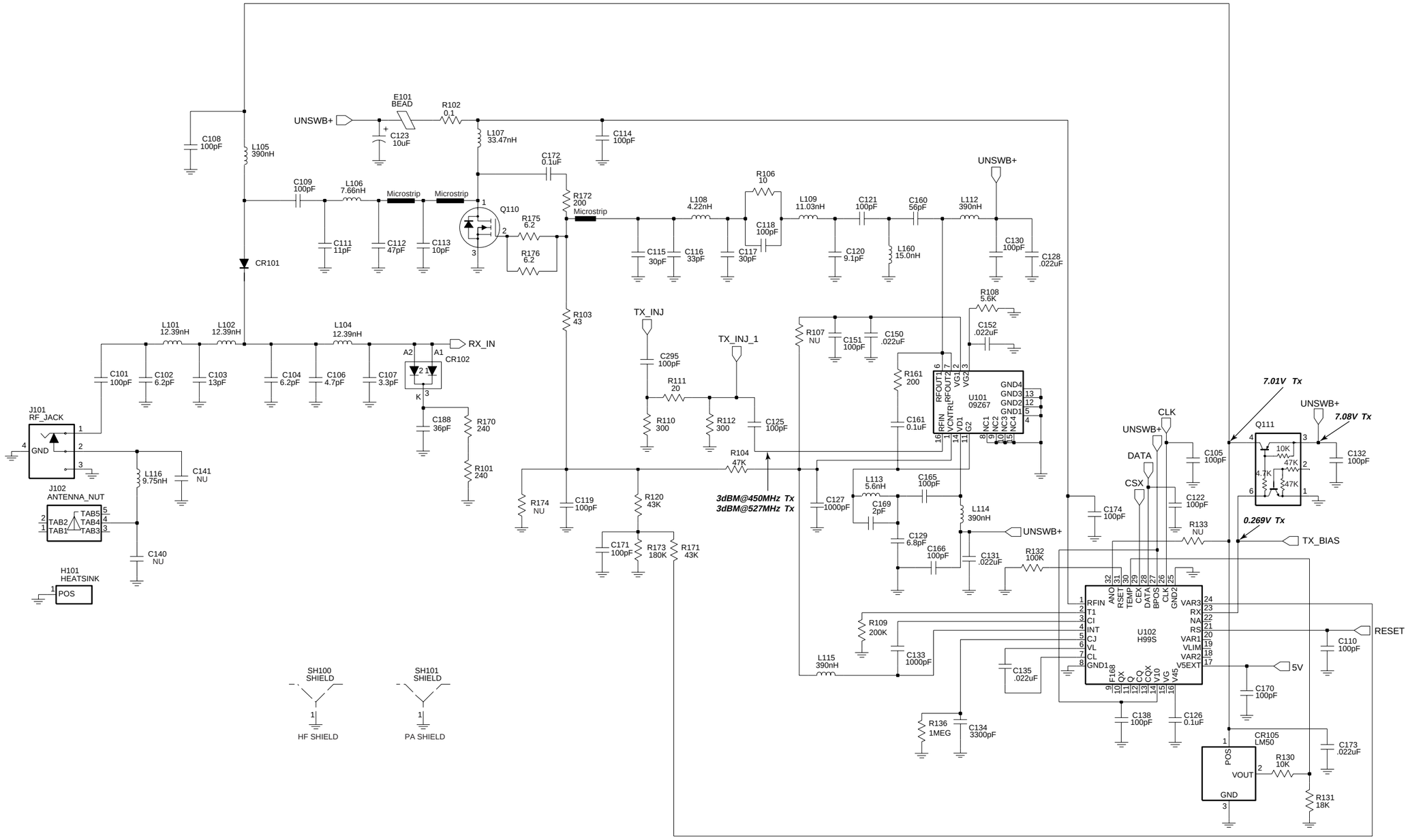


Figure 8-8: UHF Band 2 Transmitter Schematic Diagram

UHF Band 2 Radio Parts List

Circuit Ref	Motorola Part No.	Description
B501	0986237A02	Battery Contact Module
B503	3980502Z01	Backup Battery Contact, B+ (not used in GP328 Plus)
B504	3980501Z01	Backup Battery Contact, B- (not used in GP328 Plus)
C101	2113740F51	100pF
C102	2113740F22	6.2pF
C103	2113740F28	11pF
C104	2113740F22	6.2pF
C105	2113743N50	100pF
C106	2113740F19	4.7pF
C107	2113740F15	3.3pF
C108	2113743N50	100pF
C109	2113740F51	100pF
C110	2113743N50	100pF
C111	2103689A22	11pF
C112	2180605Z28	33pF
C113	2180605Z22	18pF
C114	2113743N50	100pF
C115	2113743N31	16pF
C116	2113743N27	11.0pF
C118	2113743N50	100pF
C119	2113743N50	100pF
C120	2113743N25	9.1pF
C121	2113743N50	100pF
C122	2113743N50	100pF
C123	2311049A18	10uF
C125	2113743N50	100pF
C126	2113743M24	0.1uF
C127	2113743L17	1000pF
C128	2113743M08	0.022uF
C129	2113743N23	7.5pF
C130	2113743N50	100pF
C131	2113743M08	0.022uF
C132	2113743N50	100pF
C133	2113743L17	1000pF
C134	2113743L29	3300pF
C135	2113743M08	0.022uF
C138	2113743N50	100pF
C141	2113740F25	8.2pF
C150	2113743M08	0.022uF
C151	2113743N50	100pF
C152	2113743M08	0.022uF
C160	2113743N44	56.0pF
C161	2113743M24	0.1uF
C165	2113743N44	56pF
C166	2113743N50	100pF
C169	2113743N09	2.0pF
C170	2113743N50	100pF
C171	2113743N50	100pF
C172	2113743E20	0.10uF
C173	2113743M08	0.022uF
C174	2113743N50	100pF
C188	2113743N39	36.0pF
C201	2113743N50	100pF
C202	2113743L17	1000pF
C203	2311049A56	4.7 uF
C204	2104993J02	2.2uF
C206	2113740F63	330pF
C207	2113743N40	39.0 pF
C210	2113743N50	100pF
C211	2113743N50	100pF
C212	2113743N50	100pF
C213	2113743N50	100pF
C214	2113743N50	100pF
C217	2104993J02	2.2uF
C218	2113743M24	0.1uF
C219	2113743K16	0.220uF
C220	2113743N50	100pF
C223	2113743M24	0.1uF
C224	2113743M24	0.1uF
C228	2311049J11	4.7uF
C229	2113743L17	1000pF
C230	2113743N50	100pF
C231	2113743M24	0.1uF
C232	2113743E12	0.047uF
C233	2311049A01	0 .1 uF
C234	2311049A05	0.47uF
C235	2104993J02	2.2uF
C238	2113741F17	470pF
C241	2113743N50	100pF
C242	2113743N17	4.3 pF
C243	2113743N17	4.3 pF
C244	2113740F14	3.0pF
C245	2113743N12	2.7 pF
C246	2113743N50	100pF
C247	2113743N50	100pF
C248	2113743M24	0.1uF
C250	2113743N17	4.3 pF
C251	2113743N50	100pF
C252	2113743N26	10pF
C253	2113740F07	1.5pF
C254	2113743N26	10pF
C255	2113743N50	100pF
C257	2113743N50	100pF
C258	2113743L41	0.01uF
C259	2113743L41	0.01uF
C260	2113743N50	100pF
C263	2113743N02	0.75 pF
C264	2113743N50	100pF
C271	2113743N03	1.0 PF
C272	2113743N04	1.1pF
C273	2113743M24	0.1uF
C276	2104993J02	2.2uF
C277	2113743N50	100pF
C278	2311049A09	2.2 uF
C279	2104993J02	2.2uF
C281	2113743N50	100pF
C285	2113743N50	100pF
C286	2113743M24	0.1uF
C289	2113743N50	100pF
C291	2311049A69	10.0 uF
C292	2113743M24	0.1uF
C293	2113743A27	0.470uF
C294	2113743N50	100pF
C295	2113743N50	100pF
C296	2113743M24	0.1uF
C297	2113743L41	0.01uF
C298	2113743M24	0.1uF
C301	2113743N24	8.2 pF
C302	2113743N28	12.0pF
C303	2113740L09	4.3pF
C304	2113743N27	11.0pF
C305	2113743N24	8.2pF
C307	2113743M24	0.1uF
C308	2113743N50	100pF
C309	2113743N50	100pF
C310	2113743M24	0.1uF
C312	2113743N23	7.5 pF
C313	2113743N27	11.0pF
C314	2113743M24	0.1uF
C315	2113743N50	100pF
C316	2113740L09	4.3pF
C317	2113743N27	11.0pF
C318	2113743N23	7.5pF
C319	2113743N15	3.6 pF
C320	2113743N23	7.5pF
C321	2113743N50	100pF
C322	2113743N48	82.0 pF
C323	2113743N54	150 pF
C324	2113743N33	20.0pF
C325	2113743L41	0.01uF
C326	2113743L41	0.01uF
C327	2113743N50	100pF
C328	2113743M24	0.1uF
C329	2113743M24	0.1uF
C330	2113743N26	10.0pF
C331	2113743N50	100pF
C334	2113743M08	0.022uF
C336	2113743M24	0.1uF
C337	2113743N50	100pF
C338	2113743N30	15.0pF
C339	2180478Z20	1.0uF
C340	2180478Z20	1.0uF
C341	2180478Z20	1.0uF
C342	2180478Z20	1.0uF
C343	2113743A23	0 .220uF
C344	2113743M24	0.1uF
C345	2113743M24	0.1uF
C346	2113743M24	0.1uF
C347	2113743M24	0.1uF
C348	2113743M24	0.1uF
C349	2113743E07	0.022uF
C350	2113743L05	330pF
C351	2113743N33	20.0pF
C352	2113743N28	12.0pF
C353	2113743N41	43.0 pF
C354	2113743N42	47.0pF
C355	2113743A24	0.330uF
C356	2113743M08	0.022uF
C357	2113743A23	0.220uF
C358	2113741A23	1200pF
C359	2109720D14	0.1uF
C360	2113743E07	0.022uF
C361	2113741F49	10nF
C362	2113743M08	0.022uF
C363	2311049A40	2.2 uF
C364	2113743L41	0.01uF
C370	2113743N50	100pF
C374	2113743N50	100pF
C375	2113743N50	100pF
C380	2113743L41	0.01uF
C381	2113743N18	4.7 pF
C382	2311049A59	10uF
C383	2113743N50	100pF
C384	2113743N44	56.0 pF
C385	2113743N44	56.0 pF
C386	2113743N50	100pF
C390	2113743N50	100pF
C395	2113743N50	100pF
C397	2311049A07	1.0uF
CR101	4880973Z02	Pin Diode
CR102	4802245J41	Pin Diode
CR105	5185963A15	Temperature Sense
CR201	4802233J09	Triple Diode
CR203	4862824C03	Varactor
CR241	4805649Q13	Dual Varactor
CR242	4862824C01	Varactor
CR243	4862824C01	Varactor
CR251	4802245J22	Diode Varactor
CR301	4862824C01	Varactor
CR302	4862824C01	Varactor

Circuit Ref	Motorola Part No.	Description
CR303	4880154K03	Dual Common Anode-Cathode
CR304	4862824C01	Varactor
CR305	4862824C01	Varactor
CR306	4802245J42	Ring Quad Diode
CR308	4802245J41	Pin Diode
CR310	4862824C01	Varactor
CR501	4880107R01	Rectifier
CR503	4805729G49	Led Red/Yel
E101	2484657R01	Ferrite Bead
F501	6580542Z01	FUSE 3A
FL201	4805875Z04	16.8Mhz Xtal
FL301	4802245J43	Xtal Filter 45.1 Mhz
H101	2680499Z01	Heat Spreader
J101	0985613Z01	JACK,RF
J102	0280519Z02	NUT, ANTENNA
J200	0905505Y04	20 PINS CONNECTOR
L101	2460591B28	13.37nH
L102	2460591B28	13.37nH
L104	2460591B48	15.22nH
L105	2462587N22	390 nH
L106	2460591A19	8.71nH
L107	2479990G01	33.47nH
L108	2479990A01	4.22nH
L112	2462587N42	12 nH
L113	2413926H09	5.6nH
L114	2462587N42	12nH
L115	2462587N22	391 nH
L116	2479990C02	16.28nH
L117	2409154M17	22.0nH
L160	2413926H14	15.0nH
L201	2462587Q20	2.2uH
L202	2462587Q20	2.2uH
L203	2462587Q20	2.2uH
L232	2462587P25	12uH
L241	2462587V41	390 nH
L242	2462587V26	22 nH
L243	2460593C03	Teflon Resonator
L251	2462587V41	390 nH
L253	2460593C03	Teflon Resonator
L261	2462587V29	39 nH
L271	2462587V27	27 nH
L273	2462587V25	18 nH
L281	2462587V41	390 nH
L282	2462587V41	393 nH
L301	2479990B01	11.03nH
L302	2479990B01	11.03nH
L303	2462587V26	23 nH
L304	2462587V37	180 nH
L305	2462587V23	12 nH
L306	2479990B01	11.03nH

Circuit Ref	Motorola Part No.	Description
L307	2479990B01	11.03nH
L309	2479990C02	16.28nH
L310	2462587V36	150nH
L311	2462587N65	750 nH
L314	2462587N72	2.2 uH
L325	2480646Z20	2.20uH
L330	2462587N64	680 nH
L331	2480646Z20	2.20uH
L332	2462587N53	100 nH
L340	2462587V41	394 nH
L400	2462587Q42	390NH
L401	2462587Q42	390NH
L410	2462587Q42	390NH
L411	2462587Q42	390NH
L505	2462587Q42	390nH
P100	3905643V01	Gnd Contact Finger
PB501	4070354A01	Tactile,Pushbutton
PB502	4070354A01	Tactile,Pushbutton
PB504	4070354A01	Tactile,Pushbutton
PB505	4070354A01	Tactile,Pushbutton
Q110	4813828A09	RF Power FET
Q111	4802245J50	Dual NPN/PNP
Q210	4802245J50	Dual NPN/PNP
Q241	4805218N63	NPN
Q260	4802245J50	Dual NPN/PNP
Q261	4802245J50	Dual NPN/PNP
Q301	4802245J44	NPN
Q302	4802245J44	NPN
Q315	4880214G02	NPN
Q320	4805218N63	NPN
Q400	4809579E18	MOSFET P-CHAN
Q403	4813824A17	TSTR MMBT3906
Q405	4802245J54	Dual NPN
Q410	4802245J54	Dual NPN
Q417	4802245J50	Dual NPN/PNP
Q502	5180159R01	Dual NPN
Q505	4880214G02	NPN
R101	0662057A34	240
R102	0680539Z01	POWER METAL STRIP RESISTORS
R104	0662057N15	47K
R106	0662057M26	10
R108	0662057M92	5.6K
R109	0662057N30	200K
R110	0662057M61	300
R112	0662057M61	300
R120	0662057N14	43K
R130	0662057M98	10K
R131	0662057N05	18K
R132	0662057N33	270K
R136	0662057N47	1M

Circuit Ref	Motorola Part No.	Description
R161	0662057M57	200
R170	0662057A34	240
R171	0662057N14	43K
R172	0662057A32	200
R173	0662057N29	180K
R175	0662057B59	3
R176	0662057B59	3
R191	0662057C01	0
R201	0662057N21	82K
R202	0662057N23	100K
R204	0662057N15	47K
R231	0662057M52	120
R232	0662057M69	620
R233	0662057M68	560
R241	0662057M32	18
R242	0662057M52	120
R243	0662057M98	10K
R244	0662057N03	15K
R245	0662057M59	240
R248	0662057M33	20
R248	0662057M37	30
R251	0662057M38	33
R252	0662057M60	270
R253	0662057M95	7.5K
R254	0662057M96	8.2K
R255	0662057M89	4.3K
R256	0662057M37	30
R260	0662057M74	1K
R300	0662057M82	2.2K
R301	0662057N23	100K
R302	0662057N23	100K
R303	0662057M78	1.5K
R304	0662057N01	12K
R305	0662057M66	470
R306	0662057N23	100K
R307	0662057N23	100K
R308	0662057M60	270
R309	0662057M32	18
R310	0662057M60	270
R311	0662057N10	30K
R312	0662057M83	2.4K
R313	0662057M62	330
R314	0662057M85	3K
R315	0662057N01	12K
R316	0662057A96	91K
R317	0662057M74	1K
R318	0662057A79	18K
R319	0662057A29	150
R320	0662057M74	1K
R321	0662057M83	2.4K
R322	0662057N30	200K

Circuit Ref	Motorola Part No.	Description
R324	0662057M81	2K
R325	0662057M94	6.8K
R327	0662057N11	33K
R328	0662057M12	2.7
R329	0662057M01	0
R339	0662057M01	0
R340	0662057M96	8.2K
R342	0662057N23	100K
R343	0662057M26	10
R344	0662057N01	12K
R345	0662057M98	10K
R346	0662057N17	56K
R347	0662057M74	1K
R348	0662057M87	3.6K
R349	0662057C01	0
R350	0662057N23	100K
R351	0662057C01	0
R352	0662057M86	3.3K
R355	0662057M01	0
R509	0662057M01	0
RT300	0680590Z01	THERMISTOR_33K
RT400	0680590Z01	Thermistor 33K
S501	4080710Z01	Channel Switch
S502	1880619Z02	Volume Switch
SH100	2680507Z01	Harmonic Filter Shield
SH101	2680510Z01	PA Shield
SH201	2680511Z01	Synthesizer Shield
SH202	2680511Z01	Synthesizer Shield
SH241	2604120G01	VCO Top Shield
SH242	2680514Z01	VCO Bottom Shield
SH301	2680554Z01	Rx Pre-filter Shield
SH302	2680555Z01	RX Post-filter Shield
SH303	2680509Z01	Mixer Shield
SH304	2680624Z01	Mixer Diode Shield
SH321	2680508Z01	Zif 2nd LO
SH322	2680514Z01	Zif Shield
SH323	2604082P01	AOBA Xtal Filter Shield
T301	2580541Z02	XFMR Coil
T302	2580541Z02	XFMR Coil
U101	5185130C65	LDMOS Driver
U102	5185765B28	Power Control IC
U201	5185963A27	LVFRACN
U210	5102463J61	Inverter
U211	5102463J61	Inverter
U241	5105750U54	VCO Buffer
U247	5105739X05	Regulator Linear
U248	5102463J58	3.3V Regulator
U301	5109632D83	LVZIF
Circuit Ref	**Motorola Part No.**	**Description**

Circuit Ref	Motorola Part No.	Description
B501	0986237A02	Battery Contact Module
B503	3980502Z01	Backup Battery Contact, B+ (not used in GP328 Plus)
B504	3980501Z01	Backup Battery Contact, B- (not used in GP328 Plus)
C101	2113740F51	100pF
C102	2113740F22	6.2pF
C103	2113740F28	11pF
C104	2113740F22	6.2pF
C105	2113743N50	100pF
C106	2113740F19	4.7pF
C107	2113740F15	3.3pF
C108	2113743N50	100pF
C109	2113740F51	100pF
C110	2113743N50	100pF
C111	2103689A22	11pF
C112	2180605Z28	33pF
C113	2180605Z22	18pF
C114	2113743N50	100pF
C115	2113743N31	16pF
C116	2113743N27	11.0pF
C118	2113743N50	100pF
C119	2113743N50	100pF
C120	2113743N25	9.1pF
C121	2113743N50	100pF
C122	2113743N50	100pF
C123	2311049A18	10uF
C125	2113743N50	100pF
C126	2113743M24	0.1uF
C127	2113743L17	1000pF
C128	2113743M08	0.022uF
C129	2113743N23	7.5pF
C130	2113743N50	100pF
C131	2113743M08	0.022uF
C132	2113743N50	100pF
C133	2113743L17	1000pF
C134	2113743L29	3300pF
C135	2113743M08	0.022uF
C138	2113743N50	100pF
C141	2113740F25	8.2pF
C150	2113743M08	0.022uF
C151	2113743N50	100pF
C152	2113743M08	0.022uF
C160	2113743N44	56.0pF
C161	2113743M24	0.1uF
C165	2113743N44	56pF
C166	2113743N50	100pF
C169	2113743N09	2.0pF
C170	2113743N50	100pF
C171	2113743N50	100pF
C172	2113743E20	0.10uF
C173	2113743M08	0.022uF
C174	2113743N50	100pF
C188	2113743N39	36.0pF
C201	2113743N50	100pF
C202	2113743L17	1000pF
C203	2311049A56	4.7 uF
C204	2104993J02	2.2uF
C206	2113740F63	330pF
C207	2113743N40	39.0 pF
C210	2113743N50	100pF
C211	2113743N50	100pF
C212	2113743N50	100pF
C213	2113743N50	100pF
C214	2113743N50	100pF
C217	2104993J02	2.2uF
C218	2113743M24	0.1uF
C219	2113743K16	0.220uF
C220	2113743N50	100pF
C223	2113743M24	0.1uF
C224	2113743M24	0.1uF
C228	2311049J11	4.7uF
C229	2113743L17	1000pF
C230	2113743N50	100pF
C231	2113743M24	0.1uF
C232	2113743E12	0.047uF
C233	2311049A01	0 .1 uF
C234	2311049A05	0.47uF
C235	2104993J02	2.2uF
C238	2113741F17	470pF
C241	2113743N50	100pF
C242	2113743N17	4.3 pF
C243	2113743N17	4.3 pF
C244	2113740F14	3.0pF
C245	2113743N12	2.7 pF
C246	2113743N50	100pF
C247	2113743N50	100pF
C248	2113743M24	0.1uF
C250	2113743N17	4.3 pF
C251	2113743N50	100pF
C252	2113743N26	10pF
C253	2113740F07	1.5pF
C254	2113743N26	10pF
C255	2113743N50	100pF
C257	2113743N50	100pF
C258	2113743L41	0.01uF
C259	2113743L41	0.01uF
C260	2113743N50	100pF
C263	2113743N02	0.75 pF
C264	2113743N50	100pF
C271	2113743N03	1.0 PF
C272	2113743N04	1.1pF
C273	2113743M24	0.1uF
C276	2104993J02	2.2uF
C277	2113743N50	100pF
C278	2311049A09	2.2 uF
C279	2104993J02	2.2uF
C281	2113743N50	100pF
C285	2113743N50	100pF
C286	2113743M24	0.1uF
C289	2113743N50	100pF
C291	2311049A69	10.0 uF
C292	2113743M24	0.1uF
C293	2113743A27	0.470uF
C294	2113743N50	100pF
C295	2113743N50	100pF
C296	2113743M24	0.1uF
C297	2113743L41	0.01uF
C298	2113743M24	0.1uF
C301	2113743N24	8.2 pF
C302	2113743N28	12.0pF
C303	2113740L09	4.3pF
C304	2113743N27	11.0pF
C305	2113743N24	8.2pF
C307	2113743M24	0.1uF
C308	2113743N50	100pF
C309	2113743N50	100pF
C310	2113743M24	0.1uF
C312	2113743N23	7.5 pF
C313	2113743N27	11.0pF
C314	2113743M24	0.1uF
C315	2113743N50	100pF
C316	2113740L09	4.3pF
C317	2113743N27	11.0pF
C318	2113743N23	7.5pF
C319	2113743N15	3.6 pF
C320	2113743N23	7.5pF
C321	2113743N50	100pF
C322	2113743N48	82.0 pF
C323	2113743N54	150 pF
C324	2113743N33	20.0pF
C325	2113743L41	0.01uF
C326	2113743L41	0.01uF
C327	2113743N50	100pF
C328	2113743M24	0.1uF
C329	2113743M24	0.1uF
C330	2113743N26	10.0pF
C331	2113743N50	100pF
C334	2113743M08	0.022uF
C336	2113743M24	0.1uF
C337	2113743N50	100pF
C338	2113743N30	15.0pF
C339	2180478Z20	1.0uF
C340	2180478Z20	1.0uF
C341	2180478Z20	1.0uF
C342	2180478Z20	1.0uF
C343	2113743A23	0 .220uF
C344	2113743M24	0.1uF
C345	2113743M24	0.1uF
C346	2113743M24	0.1uF
C347	2113743M24	0.1uF
C348	2113743M24	0.1uF
C349	2113743E07	0.022uF
C350	2113743L05	330pF
C351	2113743N33	20.0pF
C352	2113743N28	12.0pF
C353	2113743N41	43.0 pF
C354	2113743N42	47.0pF
C355	2113743A24	0.330uF
C356	2113743M08	0.022uF
C357	2113743A23	0.220uF
C358	2113741A23	1200pF
C359	2109720D14	0.1uF
C360	2113743E07	0.022uF
C361	2113741F49	10nF
C362	2113743M08	0.022uF
C363	2311049A40	2.2 uF
C364	2113743L41	0.01uF
C370	2113743N50	100pF
C374	2113743N50	100pF
C375	2113743N50	100pF
C380	2113743L41	0.01uF
C381	2113743N18	4.7 pF
C382	2311049A59	10uF
C383	2113743N50	100pF
C384	2113743N44	56.0 pF
C385	2113743N44	56.0 pF
C386	2113743N50	100pF
C390	2113743N50	100pF
C395	2113743N50	100pF
C397	2311049A07	1.0uF
CR101	4880973Z02	Pin Diode
CR102	4802245J41	Pin Diode
CR105	5185963A15	Temperature Sense
CR201	4802233J09	Triple Diode
CR203	4862824C03	Varactor
CR241	4805649Q13	Dual Varactor
CR242	4862824C01	Varactor
CR243	4862824C01	Varactor
CR251	4802245J22	Diode Varactor
CR301	4862824C01	Varactor
CR302	4862824C01	Varactor

* Motorola Depot Servicing only

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